SUPPLEMENT TO

Beneath Apple ProDOS

For ProDOS Version 1.1.1

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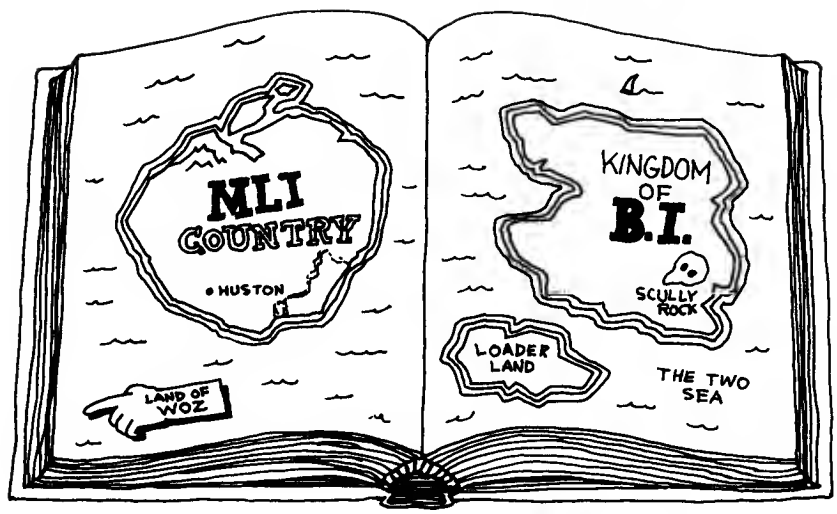


A Pro DOS ATLAS

INTRODUCTION

This supplement documents the actual structure and logic of the ProDOS system at nearly a byte by byte level. It is intended to aid experienced programmers in designing customized interfaces to ProDOS, and to provide implicit documentation of ProDOS's functions. All assembly language programmers will find this supplement useful in learning about how an operating system works. This information is presented in the spirit of helping the user to better understand how ProDOS works. The authors do not endorse indiscriminant modification of the ProDOS components. Whenever possible, standardized interfaces to ProDOS should be used to avoid the uncontrolled modifications which plagued Apple's previous operating system, DOS 3.3.

External system programs and utilities such as the FILER and CONVERT are not covered here, nor are disk controller ROM's covered other than the 5.25" controllers sold by Apple.

The information presented here is for the release of the ProDOS operating system called Version 1.1.1. A previous supplement to Beneath Apple ProDOS documented the structure of Versions 1.Ø.1 and 1.Ø.2 of ProDOS.

UNDERSTANDING THE LISTINGS

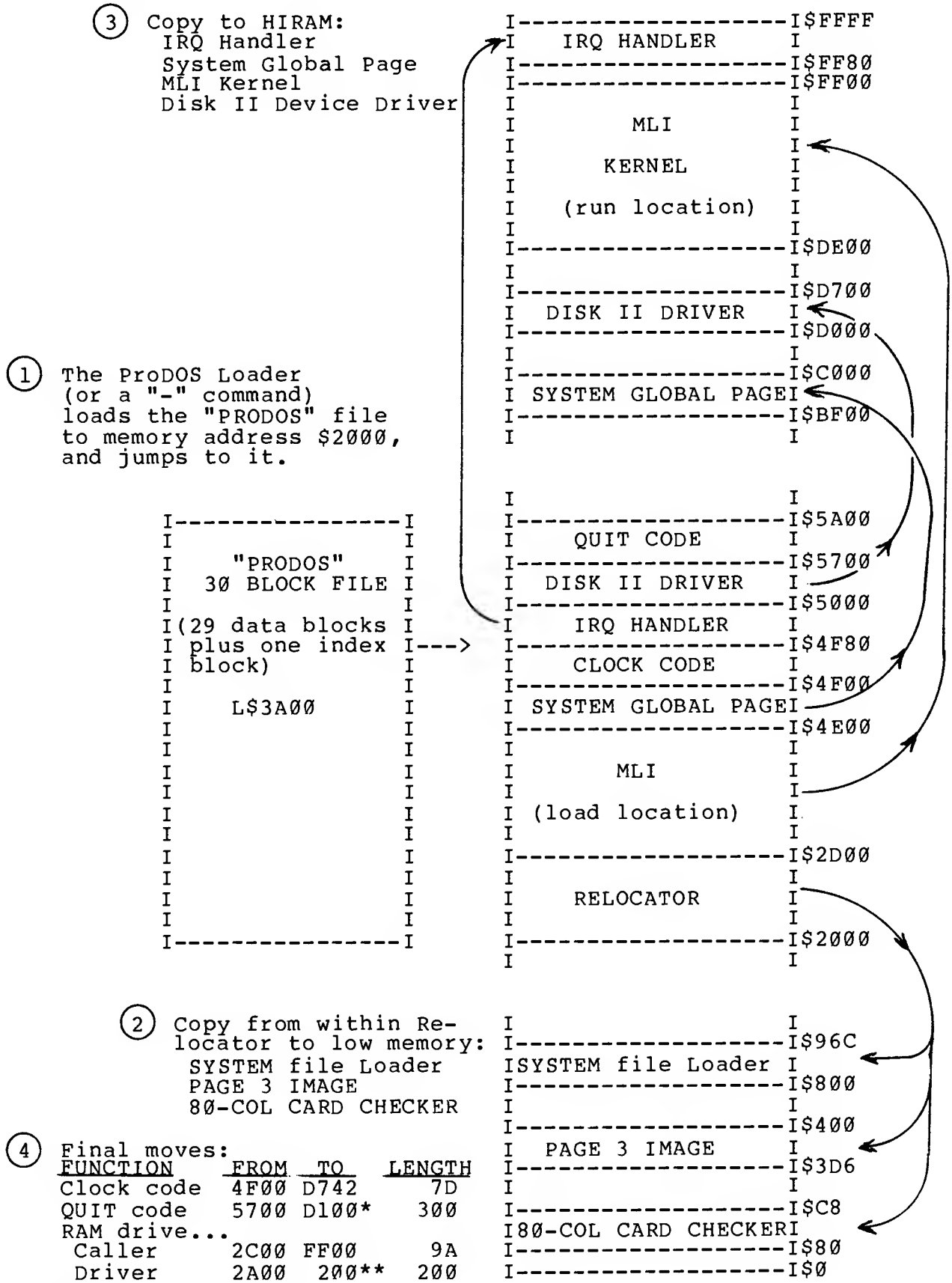
The listings which follow describe the major ProDOS components in great detail. Each module is presented separately and consists of a section defining external addresses referenced by the program (such as zero page usage, I/O select addresses, and global page fields) followed by a section describing the instructions and data in the module. Divisions between major sections and subroutines are indicated with a row of asterisks (*) and additional comments.

Each detail line gives the address of the instruction or data field being described, followed by comments. Within the comments, the following notation is used to indicate references by instructions:

(address)	A store or load reference to a memory or I/O location.
>>address	A branch or jump to an address.
<address>	A call to a subroutine at the indicated address.
-->address	A pointer to an address.

Page titles give the address of the next instruction or data area in the module to be described. These may be used to quickly locate a particular area within the component.

HOW "PRODOS" (Version 1.1.1) IS LOADED AND RELOCATED



```
ProDOS Loader -- VI.I.I -- I8 SEP 84            NEXT OBJECT ADDR: 0800
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

0800    MODULE STARTING ADDRESS
          ****************************************
          *                                      *
          *  PRODOS LOADER                       *
          *    THIS CODE IS LOADED FROM BLOCK 0  *
          *  INTO MEMORY AT $800.                *
          *  ITS PURPOSE IS TO LOAD THE "PRODOS" *
          *  FILE INTO $2000 AND JUMP TO IT.     *
          *  (PRODOS RELOCATOR IS AT $2000)      *
          *                                      *
          *  VERSION I.I.I -- I8 SEP 84          *
          *  (THE LOADER IS STILL THE SAME AS IT *
          *   WAS IN VERSION I.0.I)              *
          *                                      *
          ****************************************

          *** EXTERNAL ADDRESSES ***

0027    ROM BOOT SUBRTN BUFFER PAGE ADDR
002B    ROM BOOT SUBRTN SLOT * I6
003D    ROM BOOT SUBRTN SECTOR TO READ
0040    ROM BOOT SUBRTN CURRENT TRACK
004I    ROM BOOT SUBRTN TRACK TO READ
          -- BLOCK READ PARAMETER LIST --
0042    COMMAND NUMBER (I = READ)
0043    SLOT * I6
0044    I/O BUFFER ADDRESS ($44/$45)
0045
0046    BLOCK TO READ ($46/$47)
0047
          ------------------------------
0048    POINTER TO BLOCK READ ROUTINE
0049
004A    VOL DIR ENTRY POINTER/FIRST INDEX PAGE
004B
004C    ADDR OF SECOND PAGE OF INDEX BLOCK
004D
004E    INDEX INTO INDEX BLOCK PAGES
0050    TRACK SEEK PHASE-ON INDEX
0051    TRACK PHASE WANTED
0052    BLOCK READER RETRY COUNT
0053    CURRENT TRACK PHASE/PHASE-OFF INDEX
0054
0060    BUFFER POINTER
0061
05AE    SCREEN CENTER LINE
2000    LOAD POINT FOR RELOCATOR
C080    DISK ARM PHASE0
C088    TURN DISK DRIVE OFF
C089    TURN DISK DRIVE ON
C08C    SHIFT DATA REGISTER
```

```
ProDOS Loader -- VI.I.I -- I8 SEP 84            NEXT OBJECT ADDR: 0800
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FC58     HOME CURSOR/CLEAR SCREEN

          **************************

0800    SIGNATURE BYTE ($0I MEANS BOOT ROUTINE FOLLOWS)
        (A $03 IS STORED HERE DURING A 5.25" FLOPPY BOOT)
                -- APPLE /// BOOTING --
          THIS CODE (BLOCK 0) IS LOADED AT $A000 WHEN
          BOOTED ON AN APPLE ///.  THE APPLE /// BOOT
          ROM JUMPS TO $A000.  WHAT IS SHOWN HERE AS
          $800 ON AN APPLE II IS $A000 ON AN APPLE ///.
          THUS AN APPLE /// EXECUTES A HARMLESS
          INSTRUCTION (ORA $38,X), THEN DOES NOT BRANCH
          ON CARRY, AND JUMPS TO $AI32 ($932 ON AN
          APPLE II).  MANY THANKS TO DAV HOLLE FOR
          PROVIDING US WITH THIS APPLE /// INFORMATION.

080I ********** MAIN ENTRY ****************************************
            ON ENTRY, X = SLOT*I6
                      A = SECTOR NUMBER

  0801  ENTRY POINT FOR APPLE II
  0802  ALWAYS TAKEN (APPLE II) >>0807
  0804  JUMP TO APPLE /// LOGIC  >>A132
  0807  SAVE SLOT*16
  0809  READING SECTOR 3 NEXT?
  080B  REMEMBER THIS...
  080D  MAKE $CX FROM SLOT*I6
  0815  AND SAVE AT $49
  0819  $48/49 --> $CXFF IN ROM BOOT
  08IC  CHECK $CXFF
  08ID  BOOT ROM FOR DISK II?
  08IF  NO, NOT A 5.25" FLOPPY >>085B
  082I  GOT BOTH SECTORS OF LOADER? >>0831
  0823  NO, STOP AT SECTOR 3
  0825  STORE ON PARM (0800)
  0828  SKIP SECTOR I (GET SEC 2)
  082A  DUMMY UP $CX5C AS RETURN ADDRESS
  0830  AND CALL ROM SECTOR READ SUBRTN

          ******** LOAD PRODOS ********************
          (ENTIRE LOADER IN MEMORY NOW)

  0831  CURRENT TRACK IS ZERO
  0833  $48/49 --> $CX00
  0837  COPY A PORTION OF DISKETTE BOOT ROM
  0839  TO MY BLOCK READER SUBROUTINE (0994)
  083D  FROM $9F7 TO $A7E
  0843  MODIFY SOME BRANCHES IN THE COPIED CODE (09ID)
  0846  TO SUIT MY ERROR HANDLING TASTES (0924)
  084C  AND COPY SECTOR READ SUBROUTINE EXIT CODE (092B)
```

```
ProDOS Loader -- V1.1.I -- 18 SEP 84            NEXT OBJECT ADDR: Ø84F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  Ø84F  TO $A7F TO $A85 (ØA7F)
  Ø855  $48/49 --> DISKETTE BLOCK READER SUBRTN
  Ø859  AT $Ø986
  Ø85B  ---
  Ø85D  LEGAL DISK ROM?
  Ø85F  NO, ERROR >>Ø89Ø
  Ø861  STORE LSB OF BLOCK READER
  Ø863  STORE ZEROS IN SEVERAL THINGS
  Ø86E  COMMAND = 1 (READ BLOCK)
  Ø871  BLOCK NUMBER = 2 (VOL DIRECTORY)
  Ø875  $6Ø/6I --> $CØØ (BUFFER)
  Ø877  $4A/4B --> $CØØ (FIRST ENTRY)
  Ø879  READ VOLUME DIRECTORY BLOCKS <Ø9I2>
  Ø87C  ERROR? >>Ø8E6
  Ø87E  MOVE UP TWO PAGES IN MEMORY
  Ø882  NEXT BLOCK NUMBER
  Ø886  NOW AT BLOCK 6?
  Ø888  NO, GO READ NEXT ONE >>Ø879
  Ø88A  YES, CHECK LINK FOR VALIDITY (ØCØØ)
  Ø88D  IT SHOULD BE ZERO FOR VOL DIR (ØC01)
  Ø89Ø  BAD VOLUME DIR IF NOT ZERO >>Ø8FF
  Ø892  NO, INDEX PAST LINK AND VOL HDR
  Ø894  AND BEGIN >>Ø898
  Ø896  IF ALREADY PROCESSING, USE ENTRY LSB
  Ø898  ---
  Ø899  ADD ENTRY LENGTH TO FIND NEXT ENTRY (ØC23)
  Ø89D  STILL IN SAME PAGE? >>Ø8AC
  Ø89F  NO, BUMP ENTRY MSB
  Ø8A3  IS IT ODD? (SECOND PAGE OF A BLOCK?)
  Ø8A4  YES... >>Ø8AC
  Ø8A6  NO, JUST FINISHED LAST BLOCK?
  Ø8A8  YES, ERROR -- FILE NOT FOUND >>Ø8FF
  Ø8AA  ELSE, START JUST PAST LINKS
  Ø8AC  UPDATE LSB OF ENTRY POINTER
  Ø8AE  GET NAME LENGTH (Ø9Ø2)
  Ø8BI  MASK OFF STORAGE TYPE
  Ø8B4  COMPARE NAME WITH "PRODOS"
  Ø8B9  NOT A MATCH? >>Ø896
  Ø8BE  IF NAME MATCHES, IS IT A SAPLING FILE?
  Ø8C2  IF NOT, I CAN'T HANDLE IT >>Ø8FF
  Ø8C6  GET FILE TYPE
  Ø8C8  SHOULD BE A PRODOS SYS FILE
  Ø8CA  IF NOT, I GIVE UP >>Ø8FF
  Ø8CD  ALL IS WELL, COPY KEY BLOCK NUMBER
  Ø8CF  TO $46/47
  Ø8D6  $4A/4B AND $6Ø/6I --> $IEØØ
  Ø8D8  (BUFFER TO HOLD KEY BLOCK)
  Ø8EI  $4C/4D --> $IFØØ (SECOND PAGE)
  Ø8E3  READ A BLOCK <Ø9I2>
  Ø8E6  ERROR? >>Ø8FF
  Ø8EA  BUMP TO NEXT BLOCK BUFFER
```

```
ProDOS Loader -- V1.1.1 -- 18 SEP 84            NEXT OBJECT ADDR: Ø8EE
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  Ø8EE  $4E = OFFSET INTO INDEX BLOCK
  Ø8FØ  GET NEXT BLOCK NUMBER FROM INDEX BLOCK
  Ø8F8  BLOCK NUMBER = Ø? (END OF FILE)
  Ø8FA  NOT YET, READ A BLOCK >>Ø8E3
  Ø8FC  ELSE, JUMP TO RELOCATOR AT $2ØØØ >>2ØØØ

  Ø8FF  ERROR JUMP >>Ø93F

Ø9Ø2 *********** KERNEL NAME ***************************************

  Ø9Ø2  LENGTH OF KERNEL'S NAME
  Ø9Ø3  'PRODOS          ' "PRODOS" (KERNEL NAME)

Ø912 *********** COPY BLOCK READ BUFFER PTR ***************************

  Ø912  COPY $6Ø/6I --> $44/45
  Ø914  (BLOCK READ BUFFER POINTER)
  Ø91A  THEN GO TO BLOCK I/O ROUTINE >>Ø048

Ø91D *********** ROM SECTOR READ OFFSETS ******************************
            OFFSETS INTO ROM SECTOR READ SUBROUTINE
            TO BRANCH DISPLACEMENTS WHICH NEED TO
            BE CHANGED FOR LOADER'S PURPOSES

  Ø91D  ---

          ******** NEW BRANCH OFFSETS FOR ABOVE ***

  Ø924  ---

Ø92B *********** SECTOR READ EXIT CODE *********************************
            COPIED TO END OF DISKETTE SECTOR READ CODE

  Ø92B  GET SLOT*16
  Ø92D  AND EXIT NORMALLY
  Ø92E  RETURN
  Ø92F  RESTART BLOCK READ OPERATION >>Ø9BC

Ø932 *********** APPLE /// BOOT CODE **********************************

A132    THIS IS $AI32 WHEN BOOTED ON APPLE ///
  Ø932  MAKE IT LOOK LIKE A JSR FROM $AØØØ
  Ø938  LOAD IN BLOCK I (WE WANT SOS, NOT PRODOS)
  Ø93C  GO TO APPLE /// BLOCK READ ROUTINE >>F479

Ø93F *********** ERROR HANDLER ***************************************
```

```
ProDOS Loader -- V1.1.1 -- 18 SEP 84            NEXT OBJECT ADDR: Ø93F
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  Ø93F  HOME CURSOR/CLEAR SCREEN <FC58>
  Ø944  COPY "UNABLE TO LOAD PRODOS" MESSAGE (Ø95Ø)
  Ø947  TO SCREEN (Ø5AE)
  Ø94D  THEN GO TO SLEEP FOREVER >>Ø94D

  Ø95Ø  ---
  Ø95Ø  '*** UNABLE TO LOAD PRODOS ***'

Ø96D ********** MOVE ARM TO NEXT PHASE ******************************

  Ø96D  GET CURRENT PHASE
  Ø96F  CONVERT TO NEXT ARM PHASE
  Ø972  ADD SLOT*16
  Ø975  SELECT NEXT ARM PHASE THIS DRIVE (CØ8Ø)
  Ø97A  ---
  Ø97C  DELAY LONG ENOUGH FOR ARM TO MOVE
  Ø983  WHEN FINISHED, RETURN WITH X = SLOT*16
  Ø985  RETURN

Ø986 ********** DISKETTE BLOCK READ ROUTINE *************************
          $44/$45 --> BUFFER
          $46/$47 = BLOCK NO.

  Ø986  GET BLOCK NO. LSB
  Ø988  ISOLATE SECTOR REMAINDER
  Ø98C  SKEW SECTOR BY 2
  Ø992  AND STORE SECTOR WANTED
  Ø994  GET MSB
  Ø996  AND HIGH BIT OF TRACK
  Ø999  MERGE WITH LOW PART OF TRACK
  Ø99C  STORE TRACK WANTED
  Ø99F  TRACK*2 IS PHASE WANTED
  Ø9A3  SET PAGE ADDRESS OF BUFFER
  Ø9A7  TURN DRIVE MOTOR ON (CØ89)
  Ø9AA  READ SECTOR <Ø9BC>
  Ø9AD  NEXT PAGE
  Ø9B1  SKEW TO NEXT SECTOR
  Ø9B5  READ SECOND SECTOR OF BLOCK <Ø9BC>
  Ø9B8  THEN TURN MOTOR OFF AND EXIT (CØ88)
  Ø9BB  RETURN

          ******** DISKETTE SECTOR READ ROUTINE ***

  Ø9BC  GET CURRENT TRACK
  Ø9BF  CONVERT TO PHASE
  Ø9C5  GET CURRENT PHASE
  Ø9C7  STORE FOR PHASE OFF
  Ø9CA  SUBTRACT PHASE WANTED TO DETERMINE...
  Ø9CC  DIRECTION -- ON CORRECT TRACK NOW? >>Ø9E2
  Ø9DØ  NO, ADJUST PHASE UP...
```

```
ProDOS Loader -- V1.1.1 -- 18 SEP 84            NEXT OBJECT ADDR: Ø9D4
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  Ø9D4  OR DOWN AND...
  Ø9D6  ---
  Ø9D7  SEEK ARM ONE PHASE... <Ø96D>
  Ø9DD  IN PROPER DIRECTION <Ø96F>
  Ø9EØ  UNTIL WE ARE THERE  >>Ø9C5
  Ø9E2  ---
  Ø9E4  RETRY COUNT OF 127
  Ø9E7  ---
  Ø9E9  LOWER RETRY COUNT
  Ø9EB  RETRIES EXHAUSTED? >>Ø9BB
  Ø9EF  RETRIES FOR A $D5 HEADER
  Ø9F2  CHECK DATA REGISTER (CØ8C)
  Ø9F5  LOOP UNTIL DATA IS VALID >>Ø9F2

          ******** SECTOR READ ROUTINES ***********

Ø9F7    BEGINNING OF COPIED ROUTINES
        (SEE $C65E IN BOOT FIRMWARE DESCRIPTIONS)
        ($CX63-$CXEA IS COPIED TO $9F7-$A7E)

ØA7F    EXIT CODE FOR READ ROUTINES
        (COPIED HERE FROM $92B-$93Ø)

ØA86 ********** $A86-$BFF NOT USED **********************************
  ØA86  NOT USED

ØCØØ ********** VOLUME DIRECTORY BUFFER ****************************

ØCØØ    START OF VOLUME DIRECTORY BUFFER
ØC23    OFFSET TO ENTRY LENGTH FIELD
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

2000    MODULE STARTING ADDRESS

          *********************************
          *                               *
          *  PRODOS RELOCATOR             *
          *       LOADED AS THE FIRST     *
          *       PORTION OF THE PRODOS   *
          *       IMAGE AT $2000.         *
          *                               *
          *  VERSION 1.1.1 -- 18 SEP 84   *
          *                               *
          *********************************

          ******** ZERO PAGE ADDRESSES ************

000A    AUTOSTART ROM CHECKSUM POINTER
000B
000C    CONFIGURATION BYTE (MACHID TO BE)
0010    GENERAL PURPOSE POINTER
0011
0012    DISK TYPE (0=DISK II, 4=PROFILE)
0013     AND INPUT RELOC RANGE POINTER
0014    VOL DIR ENTRY POINTER FOR RELOCATOR
0015     AND OUTPUT RANGE PTR
0016    LENGTH OF RELOCATION RANGE
0017
0018    INPUT RELOCATION RANGE POINTER
0019
001A    END OF INPUT RANGE
001B
003C    GENERAL PURPOSE POINTER
003D
003E    GENERAL PURPOSE POINTER
003F
0040    RAMDRIVE OUTPUT POINTER
0041
0042    VARIOUS USES: PARM TO AUXMOVE,
0043     UNIT/SLOT PASSED TO RELOCATOR
0046    BLOCK NUMBER TO RAMDRIVE
0047


          ******** EXTERNAL ADDRESSES *************

0080    MACHID BUILD SUBRTN FOR 128K

0280    GENERAL PURPOSE BUFFER
0281    BUFFER+1
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

          ******** SCREEN LINE ADDRESSES **********

04B8    SCREEN BUFFER LINE
05A9    SCREEN BUFFER LINE
05B1    SCREEN BUFFER LINE
06A8    SCREEN BUFFER LINE
07A8    SCREEN BUFFER LINE
07AD    SCREEN BUFFER LINE
07D0    SCREEN BUFFER LINE

          ******** INTERP LOADER ADDRESSES ********

0800    ENTRY OF INTERP LOADER
08E2    'UNABLE TO FIND SYSTEM FILE'
090A    'INTERP FILE TOO LARGE'
092A    'UNABLE TO LOAD ...'
093B    INTERP FILE NAME ITSELF
093C    +1
094F    LENGTH OF MESSAGE
0950    MLI: OPEN LIST
0956    MLI: GET EOF
0958    EOF MARK
0959    EOF MARK+1
095A    EOF MARK+2 (MSB)
095B    MLI: READ LIST
095F    READ BUFFER ADDR
0960    +1
0963    MLI: CLOSE LIST
0965    '.SYSTEM'

          ******** MISCELLANEOUS ADDRESSES *********

0C00    VOLUME DIRECTORY BUFFER
0C23    ENTRY LENGTH
          -- RAMDRIVE VOLUME DIRECTORY --
0E04    VOLUME HDR, VOLUME NAME
0E22    VOLUME HDR, ACCESS-TOTAL BLOCKS
2A00    RAMDRIVE DEVICE DRIVER LOAD ADDRESS
2800    DIFFERENCE OF RAMDRIVE LOAD AND RUN LOCATIONS

          ******** SYSTEM GLOBAL PAGE *************

BF00    ENTRY POINT FOR MLI
BF03    QUIT VECTOR
BF06    DATE/TIME
BF10    DEVICE HANDLER TABLES
BF30    LAST DEVICE USED
BF31    NUMBER OF ACTIVE DISK DEVICES
BF32    ACTIVE DISKS SEARCH LIST
BF98    MACHINE TYPE FLAGS
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

BF99     SLOT WHICH CONTAIN CARDS WITH ROM
BFFF     TOP OF 48K RAM

           ******** I/O PORT ADDRESSES *************

C000     80 STORE OFF
C001     80 STORE ON
C002     READ MAIN RAM
C003     READ AUX RAM
C004     WRITE MAIN RAM
C005     WRITE AUX RAM
C008     MAIN STACK/ZERO PAGE
C009     ALTERNATE STACK/ZERO PAGE
C00A     INTERNAL SLOT 3 ROM
CJ0B     PERIPHERAL SLOT 3 ROM
C00C     80 COLUMN DISPLAY OFF
C00D     80 COLUMN DISPLAY ON
C018     READ 80STORE SWITCH
C030     SPEAKER
C054     USE MAIN MEMORY PART OF 80-COL CARD
C055     USE AUX MEMORY PART OF 80-COL CARD
C08I     WRITE-ENABLE HIGH RAM
C082     MOTHERBOARD ROM READ ENABLE
C083     READ/WRITE RAM 2ND 4K BANK
C08B     READ/WRITE RAM 1ST 4K BANK

           ******** INTERNAL C3ROM ADDRESSES *******

C311     MOVE TO/FROM AUXMEM SUBROUTINE
C314     TRANSFER TO/FROM AUXMEM SUBROUTINE

           ******** SLOT ROM ADDRESSES *************

C305     SLOT3 I.D. BYTE
C307     SLOT3 I.D. BYTE
C30B     SLOT3 I.D. BYTE
C30C     SLOT3 I.D. BYTE
C3FA     SLOT3 I.D. BYTE
CFFF     RESET I/O CARD ROMS

           ******** PRODOS ADDRESSES ***************

D000     START OF QUITCODE MEMORY AREA (BANK2)
DFD8     ENHANCED ROM FLAG
FF00     RAMDRIVE CALLER ADDRESS

           ******** MONITOR ROM ********************
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FB1E     PADDLE READ SUBROUTINE
FB2F     MONITOR INIT ROUTINE
FBB3     ROM VERSION BYTE
FBC0     SECONDARY VERSION BYTE (0-3)
FC58     CLEAR SCREEN
FE84     SET NORMAL VIDEO
FE89     IN#0
FE93     PR#0

2000 *********** PRODOS RELOCATOR MAIN ENTRY *************************

  2000   STORE SLOT IN MLI ONL1NE PARMS
  2005   PRINT "APPLE II PRODOS..." <2499>
  2008   SET UP FOR COMMON MOVES (220A)
  200E   RELOCATE SOME ROUTINES & DATA TO LOW MEMORY <26A6>
  2011   ERROR?  >>2036
  2013   NO, PROCEED...
  2017   BE SURE 48K OF MAIN MEMORY EXISTS (BFFF)
  201E   IF NOT, ERROR >>208E
  2026   MAKE DOUBLY SURE >>208E
  2028   SELECT MOTHERBOARD ROMS (C082)
  202B   DETERMINE MACHINE TYPE <2402>
  2030   PICK UP CONFIGURATION BYTE
  2032   64K OR MORE MEMORY?
  2034   YES, WE HAVE 64K RAM >>2039
  2036   ERROR.  MUST HAVE 64K FOR PRODOS 1.1.111 >>21C3

           ******** RELOCATE PRODOS ***************

  2039   SET UP FOR MLI MOVE (220C)
  203F   COPY/RELOCATE PRODOS ITSELF <26A6>
  2042   ERROR? >>208E
  2044   ENABLE MOTHERBOARD ROMS AGAIN (C082)
  2047   CHECK ROM I.D. BYTE (FBB3)
  204A   APPLE //e FAMILY?
  204C   NO, LEAVE I.D. BYTE AS IS >>206D
  2050   TEST ANOTHER ROM I.D. BYTE (FBC0)
  2053   SAVE BIT TEST RESULTS
  2054   GET MACHID
  2056   STRIP BITS THAT IDENTIFY MODEL
  205B   IT'S A //e IF BITS 6 & 7 ARE HIGH >>2069
  205D   ---
  205E   EITHER A //c OR A FUTURE SYSTEM
  2060   CHECK HIGH BITS OF $FBC0 AGAIN
  2061   BIT 7 ON? >>2067
  2063   YES, FUTURE SYSTEM.
  2067   IF BIT 6 ON, IT'S A FUTURE SYSTEM. >>206B
  2069   ---
  206B   REPLACE UPDATED MACHID
  206D   COPY BOOT DEVICE ID TO READ BLOCK PARMS (21FE)
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2073
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

 2073  AND AS LAST DEVICE USED (BF30)
 2076  DETERMINE PERIPHERAL CARD CONFIGURATION <252A>
 2079  BOOT DEVICE TO... (2205)
 207C  GLOBAL PAGE LAST DEVICE USED (BF30)
 2082  WRITE ENABLE BANK1 OF HIGH RAM (C08B)
 208B  COPY CLOCK CODE TO DEVICE DRIVER AREA <26A6>
 208E  ERROR? >>20BF
 2090  CHECK MACHINE TYPE AGAIN (BF98)
 2093  GOT 64K OR MORE?
 2097  NO  >>20C2
 2099  YES, QUIT VECTOR --> $FCE5
 20A3  WRITE TO HIGH RAM (BANK2) (C083)
 20AC  POINT TO QUIT CODE TABLE (2211)
 20AF  MOVE QUIT CODE TO HIGH RAM <26A6>
 20B4  STORE QUIT VECTOR START PAGE (D000)
 20B7  WRITE TO HIGH RAM (BANK1) (C08B)
 20BA  AGAIN (C08B)
 20BF  RELOCATION ERROR >>21C3
 20C2  GET MACHID YET AGAIN (BF98)
 20C5  128K?
 20C9  NO... >>20D1
 20CE  YES, ESTABLISH RAM DRIVE IN UPPER 64K <28FF>

         ******** SET UP FOR IRQ (ENHANCED ROM) **

 20D1  READ ROM (C081)
 20D4  GET IRQ VECTOR FROM ROM (FFFE)
 20DA  CARRY CLEAR IF IRQ VECTOR IN C3 ROM
 20DE  IT'S AN OLD ROM >>20FD
 20E0  READ & WRITE RAM (BANK1) (C08B)
 20E6  SWITCH TO AUX HIGH RAM (C009)
 20E9  PUT IRQ VECTOR IN AUX HIGH RAM (FFFF)
 20EF  BACK TO MAIN HIGH RAM, Z-PAGE (C008)
 20F2  PUT IRQ VECTOR IN MAIN HIGH RAM (FFFF)
 20F8  SET FLAG INDICATING
 20FA  ENHANCED IRQ LOGIC ON BOARD (DFD8)

         ******** LOOK FOR SLOT 3 VIDEO CARD *****

 20FD  ENABLE INTERNAL VIDEO FIRMWARE (C00A)
 2100  CHECK FOR ROM (BF99)
 2103  IN SLOT 3.
 2105  NONE THERE >>216D
 2107  LOOK AT THE SLOT 3 ROM (C00B)
 210A  AT OFFSET +$05 (C305)
 210D  THERE MUST BE A $38
 2111  AND AT OFFSET +$07 (C307)
 2114  THERE MUST BE AN $18
 2118  AND AT OFFSET +$0B (C30B)
 211B  THERE MUST BE A 1
 211F  AND AT OFFSET +$0C (C30C)
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2124
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

 2124  INDICATE AN 80-COL CARD.
 2128  CHECK MACHINE TYPE (BF98)
 212D  IS THIS AN APPLE III?
 212F  OK, IT'S GOT 80-COL CAPABILITY >>2165
 2131  OTHER MANUFACTURERS MUST FOLLOW THE RULES! (C3FA)
 2134  MUST HAVE BIT INSTRUCTION AT $C3FA
 2136  GOOD BOY, YOU FOLLOWED THE RULES! >>2165
 2138  GIVE CONTROL BACK TO MOTHERBOARD ROM (C00A)
 213B  TURN ON 80-COL (C001)
 213E  CHECK FOR AUX MEM. (C055)
 2143  PUT A BYTE AT AUX $400 (0400)
 2146  THE ACCUMULATOR LEFT
 2147  AND DO THE SAME WITH $400 (0400)
 214A  STILL THE SAME? (0400)
 214D  NO, NO 80-COL MEMORY >>2156
 214F  SHIFT TO THE RIGHT
 2153  STILL THE SAME? (0400)
 2156  BACK TO MAIN MEMORY (C054)
 2159  TURN OFF 80-COL (C000)
 215C  WAS 80-COL MEMORY FOUND? >>2165
 215E  NO, SO TURN OFF 80-COL FLAG (BF98)
 2161  IN MACHINE I.D. BYTE.
 2163  ALWAYS BRANCH >>216A
 2165  TURN ON 80-COL FLAG (BF98)

         ******** GET VOL LABEL ******************

 216D  MLI: ONLINE DEVICE CALL <BF00>
 2173  ERROR? >>21C3
 2178  VALID VOLUME NAME?
 217A  IF NOT, ERROR >>21C3
 217D  ELSE, BUMP LENGTH BY ONE
 2182  AND PREFIX NAME BY A "/"
 2187  MLI: SET PREFIX <BF00>
 218D  ERROR? >>21C3

         ******** READ VOLUME DIRECTORY **********

 218F  ---
 2191  $14/15 --> $C00
 2197  ---
 219C  BLOCK = 2 (VOLUME DIRECTORY) (2208)
 21A2  MLI: READ BLOCK  <BF00>
 21A8  ERROR? >>21C3
 21AC  GET NEXT BLOCK NUMBER
 21B2  IF ZERO, END OF VOLUME DIRECTORY >>21C0
 21BA  ADD TWO PAGES (ONE BLOCK) TO POINTER
 21BC  AND STOP AT $1400 IN ANY CASE
 21BE  ELSE, READ NEXT BLOCK AS WELL >>2197
 21C0  WHEN DONE, JUMP TO SYSTEM FILE LOADER >>0800
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 21C0
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

21C3 *********** ERROR HANDLER ***************************************

  21C3  ENABLE MOTHERBOARD ROMS (C082)
  21C6  CLEAR SCREEN <FC58>
  21CB  PRINT "RELOCATION/CONFIG ERROR" (21D7)
  21D4  THEN SLEEP FOREVER >>21D4

21D7 *********** DATA ************************************************

  21D7  ---
  21D7  '** RELOCATION / CONFIGURATION ERROR **'

  21FD  MLI: ONLINE PARMS
  21FE           SLOT*16 AND DRIVE
  21FF           READ THEM TO $281

  2201  MLI: SET PREFIX PARMS
  2202           PREFIX IS AT $280

  2204  MLI: READ BLOCK PARMS
  2205           DEVICE
  2206           BUFFER
  2208           BLOCK NUMBER

  220A  ADDRESS OF COMMON MOVES RELOC TABLE
  220C  ADDRESS OF PRODOS RELOC TABLE
  220E  ADDRESS OF CLOCK DRIVER RELOC TABLE
  2210  ADDRESS OF QUIT CODE RELOC TABLE

2212 *********** RELOCATION TABLES ***********************************
          +0:     00 - ZERO BLOCK OF MEMORY
                  01 - COPY BLOCK
                  02 - RELOCATE MSB ADDRESSES
                  03 - RELOCATE 2 BYTE ADDRS
                  04 - RELOCATE INSTRUCTIONS
          +1/2:   ADDR OF OUTPUT BLOCK
          +3/4:   LENGTH OF BLOCK IN BYTES
          +5/6:   ADDR OF INPUT BLOCK (IF ANY)
          +7:     NUM RANGES TO CORRECT FOR (-1)
          +8:             START PAGES
          +8+COUNT:       END PAGE ADDRESSES
          +8+COUNT+COUNT:ADDITIVE CORRECTION FACTOR

          ******** COMMON MOVES TABLE *************

  2212  COPY (SYSTEM FILE LOADER)
  2213           TO =$800
  2215           LEN=$16C
  2217           FRM=$226C
  2219  COPY (PAGE 3 IMAGE)
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 221A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  221A           TO =$3D6
  221C           LEN=$2A
  221E           FRM=$23D8
  2220  COPY (CHECKSUM)
  2221           TO =$0A
  2223           LEN=$02
  2225           FRM=$14
  2227  COPY (CHECK FOR 80-COL CARD)
  2228           TO =$80
  222A           LEN=$48
  222C           FRM=$2451
  222E  END OF TABLE

          ******** QUIT CODE MOVE TABLE ***********

  222F  COPY (QUIT CODE)
  2230           TO =$D100
  2232           LEN=$300
  2234           FRM=$5700
  2236  END OF TABLE

          ******** PRODOS RELOC TABLE *************

  2237  COPY (IRQ HANDLER)
  2238           TO =$FF80
  223A           LEN=$80
  223C           FRM=$4F80
  223E  COPY (SYSTEM GLOBAL PAGE)
  223F           TO =$BF00
  2241           LEN=$100
  2243           FRM=$4E00
  2245  ZERO (PRODOS KERNEL DATA AREA)
  2246           ADR=$D700
  2248           LEN=$700
  224A  COPY (PRODOS KERNEL)
  224B           TO =$DE00
  224D           LEN=$2100
  224F           FRM=$2D00
  2251  COPY (DISKETTE DRIVER)
  2252           TO =$D000
  2254           LEN=$700
  2256           FRM=$5000
  2258  END OF TABLE

          ******** PRODOS CLOCK TABLE *************

  2259  COPY (CLOCK CODE)
  225A           TO =$D742
  225C           LEN=$7D
  225E           FRM=$4F00
  2260  RELOCATE INSTRUCTIONS
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2261
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2261          TO =$D742
  2263          LEN=$69
  2265          FRM=$D742
  2267          FOR ADDRS=$C1XX-$C1XX
  226A          ADJUST BY=$S0
  226B  END OF TABLE

226C ************ SYSTEM FILE LOADER **********************************
         (COPIED TO AND RUN AT $800)

  226C  $10/11 --> VOLUME DIRECTORY ENTRIES
  226E  INITIALLY AT $C00
  2270  OFFSET BEYOND LINKS (+4)
  2272  (TURN NEXT INSTRUCTION INTO BIT)

          ******** SCAN DIRECTORY FOR SYSTEM FILE *

  2273  PICK UP LSB
  2276  BUMP BY ENTRY LENGTH (0C23)
  2279  UPDATE LSB
  227B  PAGE OVERFLOW? >>228F
  227D  NO, ROOM FOR ONE MORE ENTRY? (0C23)
  2282  NO, CHECK MSB
  2285  START OF A BLOCK? >>2291
  2287  NO, AT END OF DIRECTORY?
  2289  YES, FILE NOT FOUND IN DIRECTORY >>22A9
  228B  NO, START NEW BLOCK AT +4
  228D  AND UPDATE LSB
  228F  BUMP MSB
  2291  ---
  2295  CHECK FILE TYPE FOR PRODOS "SYS" FILE
  2297  NOT IT? >>2273
  229A  INACTIVE ENTRY?
  229C  IF SO, SKIP IT >>2273
  22A0  SAVE NAME LENGTH AT $280 (0280)
  22A5  MUST BE AT LEAST 8 CHARS LONG >>2273
  22A7  JUMP AROUND ERROR CODE  >>22AC
  22A9  ERROR - SYSTEM FILE NOT FOUND >>2319
  22AB  HARD BREAK IN THAT CASE
  22AC  ---
  22AF  IS THIS ".SYSTEM"?
  22B1  (SEE $23D1) (0965)
  22B5  NO, SKIP ENTRY >>2273
  22B9  CHECK ALL CHARACTERS IN NAME >>22AF

          ******** LOAD SYSTEM FILE AT $2000 ******
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 22BB
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  22BB  ---
  22BD  ---
  22BE  COPY NAME TO $281
  22C5  AND TO "UNABLE TO LOAD" MSG (093B)
  22CD  ADD BLANK AT END OF NAME
  22CF  IN MESSAGE (093C)
  22D3  NAMELEN + ERRORMSGLEN
  22D5  SAVE AT $23BB (094F)
  22D8  MLI: OPEN .SYSTEM FILE <BF00>
  22DC  (PARM LIST AT $24BC)
  22DE  ERROR? >>2326
  22E0  MLI: GETEOF <BF00>
  22E4  (PARM LIST AT $23C2)
  22E6  ERROR? >>2326
  22E8  GET MSB (SEE $23C6) (095A)
  22EB  BIGGER THAN 64K???? >>2340
  22F0  MUST BE LESS THAN $9800 BYTES
  22F2  OR ERROR... >>2340
  22F4  STORE LENGTH IN MLI READ LIST (0960)
  22FA  AND LSB TOO (095F)
  22FD  MLI: READ SYSTEM FILE INTO $2000 <BF00>
  2301  (PARM LIST AT $23C7)
  2303  NO ERRORS? >>230B
  2305  ERROR, BAD BUFFER?
  2307  YES, FILE WAS TOO LARGE >>2340
  2309  ELSE, "UNABLE TO LOAD ..." >>2326
  230B  MLI: CLOSE SYSTEM FILE <BF00>
  230F  (PARM LIST AT $23CF)
  2311  ERROR? >>2326
  2313  NO, ENABLE MOTHERBOARD ROMS (C082)
  2316  AND JUMP TO BEGINNING OF FILE >>2000

2319 ************ ERROR HANDLERS ************************************

  2319  ---
  231B  PRINT "UNABLE TO FIND A .SYSTEM FILE" (08E2)
  2324  THEN GO TO SLEEP >>234B

  2326  GET NAME LENGTH (094F)
  2329  LINE LENGTH
  232C  LESS NAME LENGTH (094F)
  232F  DIVIDED BY 2
  2330  GIVES OFFSET TO CENTER THE LINE (094F)
  2334  PRINT "UNABLE TO LOAD ..." (092A)
  233E  GO TO SLEEP FOREVER >>234B
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 233E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2340  ---
  2342  PRINT "SYSTEM PROGRAM TOO LARGE" (090A)
  234B  GO TO SLEEP FOREVER >>234B

234E ********** DATA AREA *****************************************

  234E  '**  UNABLE TO FIND A ".SYSTEM" FILE  ** '
  2376  '**  SYSTEM PROGRAM TOO LARGE  **'
  2396  '** UNABLE TO LOAD X.SYSTEM **********'
  23BB  NAME LEN +13H (LEN OF MSG)

  23BC  MLI: OPEN PARM LIST
  23BD  PATHNAME IS AT $280
  23BF  I/O BUFFER AT $1400
  23C1  REFNUM=1

  23C2  MLI: GET EOF PARM LIST
  23C3  REFNUM=1
  23C4  EOF MARK POSITION

  23C7  MLI: READ LIST
  23C8  REFNUM=1
  23C9  READ TO $2000
  23CB  LENGTH (FROM EOF MARK)
  23CD  ACTUAL LENGTH READ

  23CF  MLI: CLOSE LIST
  23D0  REFNUM=0, CLOSE ALL FILES

  23D1  '.SYSTEM'

23D8 ********** END OF SYSTEM FILE LOADER ***************************

23D8 ********** PAGE 3 VECTOR IMAGE *********************************
                    ($3D6-$3FF)
          (INCLUDES A ROUTINE AT $3D6 THAT COPIES
           CRITICAL ZERO PAGE VALUES TO AUX MEM)

  23D8  FROM MAIN Z-PAGE, (C008)
  23DB  GET X+1 VALUES STARTING AT $42
  23DD  AND PUT IN AUX Z-PAGE (C009)
  23E0  AT SAME LOCATION.
  23E5  "NO DEVICE CONNECTED" ERROR
  23E8  BACK TO MAIN Z-PAGE (C008)
  23EB  RETURN
  23EC  ADDRESS OF MLI ROUTINE
  23F2  BRK HANDLER AT $FA59
  23F4  RESET AT $FF59
  23F6  POWER UP BYTE
  23F7  & VECTOR TO $FF59 >>FF59
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 23FA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  23FA  CTL-Y VECTOR TO $FF59 >>FF59
  23FD  NMI VECTOR TO $FF59 >>FF59
  2400  IRQ HANDLER AT $BFEB (PRODOS)

2402 ********** DETERMINE MACHINE ID ********************************
                $0C=00.. 0... APPLE II
                    01.. 0... APPLE II+
                    10.. 0... APPLE IIe
                    10.. 1... APPLE IIc
                    11.. 0... APPLE /// EMULAT.
                    ..01 .... 48K RAM
                    ..10 .... 64K RAM
                    ..11 .... 128K RAM
                    .... ..1. 80 COL CARD
                    .... ...1 THUNDER CLOCK

  2402  ASSUME NOTHING AT FIRST
  2406  GET A ROM BYTE (FBB3)
  2409  APPLE II?
  240B  YES, SET BIT >>242E
  240D  NO,
  240F  APPLE IIE?
  2411  YES, SET BIT >>242E
  2413  NO,
  2415  APPLE II+?
  2417  NO, WHAT IS IT? >>2428
  241C  REALLY A II+?
  241E  YES >>242E
  2422  /// EMULATION MODE?
  2426  ---
  2427  RETURN
  2428  OTHERWISE, UNKNOWN MACHINE
  242A  CREATE INVALID INSTR AT $80
  242C  AND GO THERE >>244E
  242E  UPDATE MACHID
  2433  READ/WRITE ENABLE HIGH RAM (BANK1) (C08B)
  2438  SEE IF HIGH RAM EXISTS (D000)
  244A  IF PRESENT, MARK IN MACHID

2451 ********** LOOK FOR 64K OF AUX RAM *****************************
          (CODE MOVED TO $80 TO ALLOW BANK SWITCH)
          (ENTERED WITH MACHID IN ACCUMULATOR)

  2451  UPDATE MACHID
  2453  IIE? >>248A
  2455  YES,
  2457  BANK TO AUX MEMORY (C005)
  245D  STORE A PATTERN AT $C00 (0C00)
  2460  AND AT $800 (0800)
  2466  MAKE SURE PATTERN STAYS THERE
  2468  IT DIDN'T! >>2478
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT O8JECT ADDR: 246A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  246A  NOW SHIFT $C0Ø TO THE LEFT (ØC0Ø)
  246D  AND SHIFT THE ACCUM TO THE LEFT
  246E  ARE THEY STILL THE SAME? (ØC0Ø)
  2471  NO, AUX RAM NOT THERE.  >>2478
  2473  DID $8Ø0 MOVE TOO? (Ø8Ø0)
  2476  NO, SO WE HAVE FULL 128K! >>247B
  2478   DON'T HAVE 128K
  247B  ---
  247C  BANK BACK TO MAIN MEMORY (C0Ø4)
  2482  64K? >>248A
  2486  NO, INDICATE 128K
  2488  IN MACHID
  248A  SET UP $A/B --> "APPLE II"
  248D  IN MOTHERBOARD ROM
  248F  AT $FBØ9
  2491  BUT DO IT IN A CONVOLUTED WAY
  2498  RETURN TO CALLER

2499 *********** DISPLAY LOAD MESSAGE *********************************

  2499  CLICK SPEAKER (C03Ø)
  249C  STORE IN MAIN MEMORY  (C00C)
  249F  8Ø COL DISPLAY OFF (C0Ø0)
  24A2  SET NORMAL VIDEO <FE84>
  24A5  CALL MONITOR INITIALIZATION <FB2F>
  24A8  SET VIDEO PR#Ø <FE93>
  24AB  SET KEYBD IN#Ø <FE89>
  24AE  OUT OF DECIMAL MODE
  24AF  DISABLE FOR INTERRUPTS
  24BØ  CLEAR SCREEN <FC58>
  24B5  PRINT "APPLE //" (24E3)
  24CØ  PRINT "PRODOS 1.1.1 ETC." (24EB)
  24CB  PRINT A BLANK AT $6A8 (25Ø2)
  24D6  PRINT "COPYRIGHT ETC." (25Ø3)
  24DF  CLICK SPEAKER AGAIN (C03Ø)
  24E2  DONE

24E3 *********** DATA AREA ****************************************

  24E3  'APPLE //'
  24EB  'PRODOS 1.1.1  18-SEP-84'
  25Ø2  ' '
  25Ø3  'COPYRIGHT APPLE COMPUTER, INC., 1983-84'

252A *********** DETERMINE SLOT CONFIGURATION ************************

  252A  ---
  252C  ZERO SOME THINGS
  2533  NO DISKS ACTIVE YET (BF31)
  2538  $1Ø/11 --> $C7Ø0 (LOOP THRU ALL SLOTS)
  253A  RESET I/O CARD ROMS (CFFF)
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 253F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  253F  CHECK SIGNATURE ON CARD FOR DISK DEVICE
  2545  NOT DISK? >>25AD
  2548  GET $CSFF BYTE (TYPE OF DISK)
  254D  DISK II? >>256F
  254F  NO, PROFILE?
  2551  NO? THEN NOT A DISK >>25AD

        ******** PROFILE FOUND ******************

  2553  ELSE, SAVE AS LSB OF BLOCK READ SUBRTN
  2555  GET $CSFE (STATUS BYTE)
  2558  CAN WE AT LEAST READ STATUS AND DATA?
  255C  YES? >>2563
  255E  NO,
  2561  NOT A DISK AFTER ALL >>25AD
  2563  GET STATUS 8YTE AGAIN
  2567  TOP NIBBLE IS DEVICE ID
  2568  PROFILE SHOULD BE $Ø4
  256A  CHECK NUMBER OF VOLS (SHOULD BE Ø)
  256B  GET SLOT NO. FOR DEVICE DRIVER LOC.
  256D  AND GO DO COMMON PROCESSING FOR DISK >>2579

        ******** DISK II FOUND ******************

  256F  $12 ZERO FOR DISK II
  2571  GET DISK II DEVICE DRIVER LOCATION (266A)
  2575  ($F8Ø0 OR $B8Ø0) (266B)
  2578  DISK II HAS 2 DRIVES

        ******** DISK FOUND *********************

  2579  SAVE DEVICE ADDRESS
  257B  SET UP INDEX OF SLOT*2
  2583  BUILD ST (S=SLOT, T=Ø DISKII,4 PROFILE)
  2586  BUMP DEVICE COUNT BY ONE (BF31)
  258A  AND ADD DRIVE TO SYSTEM SEARCH LIST (BF32)
  258E  NUMBER OF DRIVES
  259Ø  ONLY ONE? >>2596
  2592  NO, BUMP INDEX
  2593  AND MARK SECOND DRIVE IN SEARCH LIST (BF32)
  2596  STORE FINAL DEVICE COUNT (BF31)
  259B  SET UP DISK DEVICE DRIVER VECTORS (BF11)
  259E  IN SYSTEM GLOBAL PAGE >>25A8
  25AØ  (SET UP TWO VECTORS FOR A DISK II) (BF21)
  25A8  ---
  25AC  I RECOGNIZE THIS CARD
  25AD  GO MARK SLTBYT TO SHOW ROMS IN SLOT <25FA>
  25B4  DO ALL CARDS EXCEPT
  25B6  SLOT Ø ($C0Ø0) >>253A
  25BC  GET LAST DISK DEVICE IN SEARCH LIST (BF32)
  25C2  BOOT DRIVE?  (BF3Ø)
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 25C6
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  25C6  NO, KEEP LOOKING >>25CA
  25CA  ---
  25CD  GET DEVICE COUNT (BF31)
  25D1  IS BOOT DRIVE IN LIST? >>25E7
  25D3  SO IT WILL BE SEARCHED FIRST... (BF30)
  25D6  STORE BOOT AT END OF SEARCH LIST (BF32)
  25DA  ANY OTHERS? >>25EE
  25DD  YES, SECOND DRIVE? >>25E7
  25E1  STORE IT RIGHT BEHIND BOOT DRIVE (BF32)
  25E5  NOW ANY MORE? >>25EE
  25E7  ---
  25E8  YES, MOVE OTHERS AHEAD IN LIST (BF32)
  25EE  DO CHECKSUM ON ROM <267C>
  25F1  NOT AN AUTOSTART ROM? >>25F7
  25F3  AUTOSTART, STORE FINISHED MACHID (BF98)
  25F6  AND LEAVE
  25F7  NONAUTOSTART, UNKNOWN MACHINE, SO CRASH! >>2428

25FA ********** IDENTIFY I/O CARD **********************************

  25FA  DO WE ALREADY RECOGNIZE THIS CARD? >>265B
  25FC  NO,
  25FE  CHECK SIGNATURE ON CARD FOR THUNDER CLOCK
  2603  NOT IT? >>261F
  2609  THUNDER CLOCK, WHICH SLOT?
  260B  SAVE SLOT NUMBER (LESS 1)
  260D  IN CLOCK CODE RELOCATION TABLE (226A)
  2612  ENABLE CLOCK/CALENDAR JUMP IN GLOBALS (BF06)
  2617  IS THERE A MACHID? >>25EE
  2619  IF SO, MARK THAT A CLOCK IS PRESENT
  261B  AND UPDATE MACHID
  261D  GO MARK ROM IN THIS SLOT >>265B
  261F  ---
  2621  CHECK SIGNATURE OF MYSTERY CARD
  2623  STANDARD BASIC SUPPORTED?
  2625  NO, UNKNOWN CARD >>264A
  2629  YES,
  262B  DOUBLE CHECK BASIC SUPPORTED
  262D  NO, UNKNOWN CARD >>264A
  2631  YES,
  2633  GENERIC SIGNATURE?
  2635  NO, UNKNOWN CARD >>264A
  2638  YES,
  263C  80 COLUMN CARD?
  263E  NO, UNKNOWN CARD >>264A
  2642  GET MACHID IF WE HAVE ONE >>25EE
  2644  MARK 80 COLUMN CARD PRESENT
  2646  AND UPDATE MACHID
  2648  GO MARK ROM ON CARD PRESENT >>265B
  264A  UNKNOWN CARD, CHECK ROM TO...
  264E  SEE IF IT WILL HOLD A VALUE...
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2654
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2654  FOR SOME TIME.
  265B  IF SO, WE HAVE A CARD IN SLOT
  265D  CONVERT SLOT NUMBER...
  2660  TO A BIT POSITION (2674)
  2663  AND OR INTO SLTBYT (BF99)
  2669  RETURN TO CALLER

266A ********** DATA AREA ******************************************

  266A  DISK DEVICE DRIVER ENTRY POINT
  266B  (2 BYTE ADDRESS)

  266C  DEVICE SIGNATURE FOR:
  266E  +0,+2,+4,+6 = THUNDERCLOCK
  2670  +1,+3,+5,+7 = DISK
  2672  (+7 NOT CHECKED)

  2674  BIT POSITION TABLE FOR SLOTS
  2677   (ALSO USED IN CHECKSUM CALCS)

267C ********** COMPUTE AUTOSTART ROM CHECKSUM **********************

  267C  ---
  267D  GET ZERO IN INDEX REGISTER (2674)
  2680  SUM $FB09 ("APPLE II") IN ROM
  2687  UPDATE CHECKSUM (2674)
  268E  DO 8 BYTES IN ALL (2677)
  2694  MOVE LENGTH TO HIGH NIBBLE
  2699  AND COMBINE WITH CHECKSUM (2674)
  269C  FUDGE FACTOR
  269E  SHOULD COME OUT ZERO >>26A3
  26A0  IT DID...RETURN WITH MACHID
  26A2  RETURN
  26A3  ELSE, RETURN WITH ZERO MACHID
  26A5  RETURN

26A6 ********** RELOCATION ROUTINE **********************************
            (X/Y REGS CONTAIN TABLE ADDR)

  26A6  SAVE PASSED TABLE ADDRESS
  26AA  ---
  26AC  GET OPERATION CODE
  26AE  VALID OPERATION? (4 OR LESS)
  26B0  NO, ERROR >>2724
  26B4  $14/15 --> OUTPUT BLOCK
  26BE  $16/17 --> LENGTH
  26C7  NEGATIVE LENGTH? >>2726
  26C9  CHECK OPERATION CODE
  26CA  ZERO BLOCK? >>272F
  26CD  NO, $12/13 = $18/19 --> INPUT BLOCK
  26D7  $1A/1B --> END OF INPUT BLOCK
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 26E4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  26E4  COPY BLOCK ONLY? >>2753
  26E6  SAVE RELOCATION OPERATION CODE (287F)
  26EC  SAVE NUMBER OF RANGES TO CHECK (2880)
  26F0  ---
  26F1  COPY START PAGES TO TABLE
  26FC  ---
  26FD  AND END PAGES
  2708  ---
  2709  AND FINALLY, RELOCATION FACTORS
  2711  BUMP TO NEXT TABLE ENTRY <2759>
  2714  RESTORE OPERATION CODE (287F)
  2719  RELOCATE INSTRUCTIONS? >>2729

271B ********** 2/3 - RELOCATE ADDRESSES ***************************

  271B  NO, RELOCATE ADDRESS <27BD>
  271E  COPY BLOCK <2766>
  2721  AND CONTINUE IF ALL WENT WELL >>26AA
  2724  NORMAL EXIT
  2725  RETURN
  2726  JUMP TO ERROR EXIT >>27F3

2729 ********** 4 - RELOCATE INSTRUCTIONS ***************************

  2729  RELOCATE INSTRUCTIONS <27CF>
  272C  AND THEN COPY BLOCK >>271E

272F ********** 0 - ZERO BLOCK ***************************************

  272F  BUMP TABLE POINTER TO NEXT ENTRY <2759>
  2734  GET NUMBER OF PAGES TO DO
  2736  NO FULL PAGES? >>2744
  2739  ZERO AN ENTIRE PAGE
  273E  BUMP PAGE POINTER
  2740  AND DECREMENT LENGTH
  2744  GET LENGTH OF PARTIAL LAST PAGE
  2746  NO PARTIAL PAGE? >>2750
  2749  ZERO PARTIAL PAGE TOO
  2750  DONE, GET NEXT TABLE ENTRY >>26AA

2753 ********** 1 - COPY BLOCK ****************************************

  2753  BUMP TABLE POINTER <2759>
  2756  AND GO COPY BLOCK >>271E

2759 ********** ADVANCE TABLE POINTER *********************************
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2759
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2759  ADD FINAL ENTRY INDEX..
  275D  TO TABLE ENTRY ADDRESS
  2765  RETURN

2766 ********** COPY BLOCK ****************************************

  2766  ---
  276A  INPTR < OUTPTR? >>2777
  276C  NO, GREATER? >>279A
  276E  MSB'S ARE EQUAL, CHECK LSB'S ALSO
  2776  EXIT IF EQUAL
  2777  INPTR < OUTPTR, COPY LAST PAGES FIRST
  277B  BUMP BOTH INPTR AND OUTPTR BY...
  277D  LENGTH-1 TO POINT AT LAST BYTE
  2785  START WITH SHORT LAST PAGE LENGTH
  2789  ---
  278A  COPY BYTES BACKWARDS THROUGH MEMORY
  2791  DROP ADDRESSES AND LENGTH BY 256
  2797  AND CONTINUE UNTIL FINISHED >>2789
  2799  RETURN

  279A  INPTR > OUTPTR, COPY PAGES FORWARD
  279C  HOW MANY FULL PAGES LEFT?
  279E  NONE? >>27AF
  27A0  COPY A FULL PAGE
  27A7  AND BUMP ADDRESSES
  27AB  DECREMENT LENGTH BY 256
  27AD  AND DO ALL PAGES >>27A0
  27AF  GET LENGTH OF LAST PAGE
  27B1  EVEN PAGE BOUNDARY? >>27BC
  27B3  NO, COPY SHORT LAST PAGE
  27BC  RETURN

27BD ********** ADDR/PAGE RELOCATE *********************************

  27BD  GET TABLE ENTRY TYPE (287F)
  27C1  GET PAGE TO RELOCATE
  27C3  RELOCATE A SINGLE ADDRESS <27FB>
  27C6  BUMP BY 1 OR 2 BYTES (287F)
  27C9  ADVANCE POINTER <2817>
  27CC  AND CONTINUE UNTIL COMPLETE >>27BD
  27CE  RETURN

27CF ********** INSTRUCTIONS RELOCATE ******************************

  27CF  ---
  27D1  GET 6502 OPCODE
  27D3  COMPUTE INSTRUCTION LENGTH <282A>
  27D6  INVALID OPCODE? >>27E9
  27D8  3 BYTE INSTRUCTIONS?
```

```
ProDOS ReIocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 27DA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  27DA  NO >>27E3
  27DC  YES, 3 BYTE ADDRESS TO CORRECT
  27DE  RELOCATE ADDRESS <27FB>
  27EI  AND ADVANCE BY 3 BYTES
  27E3  NEXT INSTRUCTION <28I7>
  27E6  CONTINUE UNTIL FINISHED >>27CF
  27EB  RETURN

        ******** INVALID OPCODE *****************

  27E9  POP THE STACK
  27EB  RETURN WITH POINTER TO BAD INSTRUC.
  27EF  DIE HORRIBLY
  27F2  RETURN

27F3 *********** ERROR RETURN ***************************************

  27F3  RETURN WITH POINTER
  27F7  EXIT WITH ERROR CODE
  27FA  RETURN

27FB *********** RELOCATE ABSOLUTE ADDRESS ***************************

  27FB  GET PAGE NUMBER TO CHECK
  27FD  GET NUMBER OF RANGES (LESS ONE) (288Ø)
  28ØØ  IS IT PRIOR TO START OF THIS RANGE? (2881)
  28Ø3  YES? >>28ØC
  28Ø5  NO, IS IS AFTER END OF RANGE? (2889)
  28Ø8  NO? >>28IØ
  28ØC  ---
  28ØD  CHECK EACH RANGE >>28ØØ
  28ØF  RETURN

  28IØ  ---
  28II  ADD FUDGE FACTOR TO ADDRESS (2891)
  28I4  AND UPDATE IT
  2816  RETURN

2817 *********** BUMP POINTER TO NEXT ADDR ***************************

  2817  ---
  2BI8  ADD LENGTH TO POINTER
  2BIF  CHECK TO SEE IF WE ARE DONE
  2825  ---
  2829  RETURN
```

```
ProDOS ReIocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 282A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

282A *********** COMPUTE INSTRUCTION LENGTH ***************************

  282A  A-REG CONTAINS OPCODE
  282B  ISOLATE LAST TWO BITS FOR LATER
  283Ø  USE LAST 6 BITS AS TABLE INDEX
  2832  GET BYTE WITH 4 LENGTHS IN IT (283F)
  2835  ---
  2836  USING TOP TWO BITS AS INDEX... >>283C
  2838  SHIFT DOWN THE PROPER LENGTH
  283C  AND ISOLATE IT IN A-REG
  283E  RETURN

283F *********** 65Ø2 OP LENGTH TABLE *********************************
          EACH BYTE CONTAINS FOUR 2 BIT LENGTHS

  283F  ---

287F *********** RELOCATION DATA ***************************************

  287F  RELOCATION CODE (3,2,I)
  2B8Ø  NUMBER OF RANGES
  2881  START OF RANGE PAGES
  2889  END OF RANGE PAGES +I
  2891  ADDITIVE FACTORS

2899 ********** 2899-28FE NOT USED ***********************************

  2899  NOT USED

28FF *********** SET UP RAMDRIVE IN AUXMEM ****************************
          (THIS ROUTINE PUTS THE RAMDRIVE DEVICE DRIVER
           IN MEMORY, PUTS THE ADDRESS OF THE DRIVER
           IN THE DEVICE DRIVER ADDRESS LIST, AND
           ADDS THE RAMDRIVE TO THE ONLINE DEVICE LIST.)

  28FF   SUBROUTINE STARTS WITH NOP
  29Ø2  RELOCATE RAMDRIVE CALLER NOW AT.. (2CØØ)
  29Ø5  TO HIGH RAM AT.. (FFØØ)
  29ØD  NOW PREPARE TO MOVE
  29ØF  RAMDRIVE DEVICE DRIVER
  29II  INTO AUX RAM AT $2ØØ.
  2914  $3C/$3D --> $2AØØ
  29I8  $3E/$3F --> $2BFF
  291D  $42/43 --> $2ØØ
  2923  COPY MAIN MEM TO AUX MEM
  2924  USE AUXMOVE TO COPY IT <C3I1>
  2929  SLOT 3, DRIVE 2 DEVICE DRIVER.. (BF26)
  292C  IS AT $FFØØ
  293I  BUMP DEVICE COUNT (BF31)
  2937  ADD DEVICE TO ONLINE DEVICE LIST
  293C  RETURN
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 293C
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

293D ********** 293D-29FF NOT USED **********************************

  293D  ---
  2989


2A00 ******* RAMDRIVE (/RAM) DEVICE DRIVER ***************************
         (COPIED TO AND RUN AT $200 IN AUX RAM)
         (THIS IS THE MAIN PART OF THE DEVICE DRIVER.
          IT IS CALLED BY THE RAMDRIVE CALLER
          WHICH IS LOCATED AT $FF00 IN MAIN MEMORY.)

  2A00  SAVE THE 80STORE SETTING (C018)
  2A04  FORCE RAM READ/WRITE (C000)
  2A09  COPY INPUT PARAMETERS
  2A0B  TO AUX PAGE 3. (03BD)
  2A11  FIRST TIME IN OR FORMAT COMMAND? (03BC)
  2A14  NO, SKIP FORMAT LOGIC >>2A4F

        ******** FORMAT RAMDRIVE ***************

  2A16  YES, SAVE BLOCK WANTED
  2A18  PAGES $E AND $F ARE ACTUAL DIRECTORY
  2A1A  ZERO THE DIRECTORY BLOCK <0333>
  2A1F  COPY VOLUME NAME ($F3,"RAM") (03D2)
  2A22  TO VOLUME DIRECTORY BLOCK (0E04)
  2A28  LAST BYTE IN VOLUME BITMAP
  2A2A  IS AN $FE (03D1)
  2A2D  $FF TO ACCUM.
  2A30  14 $FF'S TO BITMAP (03C2)
  2A36  SET FIRST BITMAP BYTE TO ZERO (03C2)
  2A39  COPY 8 BYTES
  2A3B  OF DIRECTORY DATA (03D6)
  2A3E  TO VOLUME DIRECTORY BLOCK (0E22)
  2A44  WAS THIS A FORMAT COMMAND? (03BC)
  2A47  YES, DONE. >>2AAA
  2A49  NO, SET FLAG & CONTINUE WITH READ/WRITE (03BC)
  2A4C  RESTORE BLOCK NUMBER (03C1)

        ******** READ/WRITE RAMDRIVE BLOCK ******

  2A4F  CONVERT BLOCK NUMBER TO PAGE NUMBER (03C1)
  2A55  THIS PAGE IN HIGH RAM?
  2A57  YES >>2A63
  2A59  NO, IS IT BLOCK 3? (VOLUME BIT MAP)
  2A5B  NO >>2A60
  2A5D  YES, DUMMY UP A PHONY BITMAP BLOCK >>038C
  2A60  ELSE, NORMAL READ/WRITE >>0342
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2A60
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

        ******** READ/WRITE IN AUX HIGH RAM *****

  2A63  SAVE PAGE NUMBER
  2A64  FIND IT IN MEMORY <02E5>
  2A67  REMEMBER READ/WRITE STATUS
  2A68  WRITING? >>2AB8
  2A6A  GET SAVED PAGE NUMBER
  2A6B  DOES OPERATION INVOLVE BANK1?
  2A6D  NO, USE BANK2 >>2A73
  2A6F  YES, FORCE IT TO $DXXX
  2A71  AND USE BANK1 OF AUX HIGH RAM >>2A79
  2A73  USE BANK2 OF AUX HIGH RAM (C083)
  2A76  AND WRITE ENABLE IT (C083)
  2A79  SAVE PAGE NUMBER IN BLOCK (03C1)
  2A7C  PRESERVE HIS BUFFER ADDR (03C0)
  2A80  DURING THE FOLLOWING TRANSFER... (03BF)
  2A83  SELECT AUX HIGH RAM (C009)
  2A88  USE RAMDRIVE BUFFER AS AN "IN BETWEEN" (03C0)
  2A8B  AREA WHEN TRANSFERING TO/FROM AUX HIGH RAM.
  2A8D  PRETEND THAT WAS CALLER'S BUFFER (03BF)
  2A90  AND SET UP POINTERS AGAIN <02E5>
  2A94  COPY BLOCK TO OR FROM RAMDRIVE BUFFER
  2A9F  THEN BACK TO MAIN ZERO PAGE  (C008)
  2AA2  RESTORE CALLER'S BUFFER ADDRESS (03BF)
  2AA9  READING OR WRITING?
  2AAA  IF WRITING, DONE >>2AB5
  2AAC  IF READING, WRITE ENABLE HIGH RAM (BANK1) (C08B)
  2AB2  AND COPY RAMDRIVE BUFFER TO HIS BUFFER <02BE>
  2AB5  THEN EXIT >>03DE
  2AB8  IF WRITING, COPY HIS BLOCK TO RAMDRIVE BUFFER <02BE>
  2ABB  THEN COPY RAMDRIVE BUFFER TO AUX HIGH RAM >>026A

2ABE *********** COPY BLOCK IN MAIN 48K ******************************

  2ABE  THIS ENTRY IS FOR THE RAMDRIVE BUFFER
  2AC0  THIS ENTRY ASSUMES AUX MEM PAGE NUMBER IN ACCUM (03C1)
  2AC3  THIS ENTRY ASSUMES PAGE NUMBER ALREADY SET <02E5>
  2AC6  WRITING TO RAMDISK? >>2ADB
  2AC8  NO, WRITE TO MAIN 48K RAM (C004)
  2ACC  COPY BLOCK AUX MEM --> MAIN MEM
  2AD7  WRITE TO AUX MEM AGAIN (C005)
  2ADA  DONE (RETURN HERE AFTER FOLLOWING JUMP)
  2ADB  ---
  2ADD  GO BACK TO MAIN MEM PART OF DRIVER (03ED)
  2AE0  TO COPY MAIN MEM --> AUX MEM
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2AE2
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


2AE5 ********** SET BUFFER AND BLOCK ADDRESSES **********************

  2AE5  GET COMMAND (Ø3BD)
  2AE8  READ OR WRITE?
  2AE9  WRITE? >>2BØ8
  2AEB  NO, GET HIGH BYTE OF BUFFER TO BE READ (Ø3CØ)
  2AF2  AND LOW BYTE OF BUFF ADDRESS (Ø3BF)
  2AF5  $42/43 --> FIRST PAGE OF BUFFER
  2AF7  $4Ø/41 --> SECOND PAGE OF BUFFER
  2AF9  GET PAGE NUMBER (Ø3C1)
  2AFE  $3C/3D --> BLOCK IN RAMDRIVE
  2BØØ  $3E/3F --> SECOND PAGE OF SAME
  2BØ6  ALWAYS BRANCH AROUND WRITE CODE >>2B23

  2BØ8  WRITE,  (Ø3CØ)
  2BØF  $3C/3D --> MAIN MEMORY ADDRESS OF BUFFER TO BE WRITTEN (Ø3BF)
  2B12  $3E/3F --> SECOND PAGE OF SAME
  2B19  $42/43 --> BLOCK IN RAMDRIVE
  2B1B  $4Ø/41 --> SECOND PAGE OF SAME
  2B23  SET SECOND PAGE ADDRESSES
  2B27  EXIT

2B28 ********** SEND HIM A DUMMY BLOCK OF ZEROES**********************

  2B28  ZERO RAMDRIVE BUFFER IN CASE READING <Ø331>
  2B2B  COPY BETWEEN RAMDRIVE BUFFER AND HIS BUFFER <Ø2C3>
  2B2E  AND EXIT >>Ø3DE

2B31 ********** ZERO BLOCK BUFFER ***********************************

  2B31  ZERO RAMDRIVE BUFFER
  2B33  ZERO BLOCK INDICATED BY ACCUM. (Ø3C1)
  2B36  SET UP BUFFER POINTERS <Ø2E5>
  2B3A  ZERO BOTH PAGES OF BLOCK
  2B41  AND EXIT

2B42 ********** READ/WRITE IN LOW 48K ********************************

  2B42  BLOCK 2 (VOLUME DIRECTORY)?
  2B44  NO >>2B4A
  2B46  YES, CONVERT IT BLOCK 7
  2B48  AND GO DO I/O NOW >>2B58
  2B4A  ELSE, LESS THAN BLOCK 8? (BUG--$D SHOULD BE $F111)
  2B4C  YES, RETURN WITH DUMMY ZERO BLOCK. >>2B28
  2B4E  START MSB AT ZERO
  2B5Ø  GET ORIGINAL BLOCK NUMBER
  2B52  BLOCK $5D THROUGH $5F?
  2B54  NO >>2B5B
  2B56  YES, ADJUST TO $D THROUGH $F
  2B58  AND USE $1AØØ THRU $1FFF IN RAMDRIVE. >>Ø385
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2B5B
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2B5B  ELSE, FOR BLOCKS $8 THRU $5C
  2B5C  SUBTRACT 8
  2B5E  AND DIVIDE BY 17 ($11)
  2B64  XREG IS QUOTIENT
  2B65  HAS TO BRANCH!! >>2B5E
  2B68  AND AREG IS REMAINDER
  2B69  REMAINDER OF 1?
  2B6B  NO >>2B73
  2B6D  YES, EVERY 17TH BLOCK GOES
  2B6E  IN $1ØØØ-$1BFF AREA
  2B6F  BY ADDING 8 TO QUOTIENT
  2B71  AND GO DO IT >>2B85
  2B73  BUMP QUOTIENT (START AT $2XXX)
  2B75  SHIFT IT TO TOP NIBBLE OF BYTE
  2B7D  GOT A REMAINDER? >>2B81
  2B7F  IF SO, DECREMENT IT (NOT USING 1)
  2B81  THEN ADD INTO TOP NIBBLE
  2B82  TO FORM $1Ø THRU $5F (Ø3C1)
  2B85  BLOCK*2 FOR PAGE NUMBER
  2B86  COPY THE BLOCK <Ø2CØ>
  2B89  THEN EXIT >>Ø3DE

2B8C ********** READ/WRITE BITMAP BLOCK ******************************

  2B8C  USE RAMDRIVE BUFFER (NO ACTUAL BITMAP BLOCK)
  2B91  SET UP BUFFER POINTERS <Ø2E5>
  2B94  WRITING? >>2BA9
  2B96  NO, READING - ZERO THE RAMDRIVE BUFFER <Ø336>
  2B9B  COPY BITMAP IMAGE TO RAMDRIVE BUFFER (Ø3C2)
  2BA3  COPY BLOCK BACK TO CALLER'S BUFFER <Ø2C3>
  2BA6  THEN EXIT >>Ø3DE

  2BA9  WRITING, COPY HIS BUFFER TO RAMDRIVE BUFFER <Ø2C3>
  2BAC  SET UP BUFFER POINTERS <Ø2E5>
  2BB1  COPY 16 BITMAP BYTES FROM RAMDRIVE BUFFER
  2BB3  INTO PAGE 3 BITMAP IMAGE (Ø3C2)
  2BB9  THEN EXIT >>Ø3DE


2BBC ********** RAM DRIVE DATA (AT $3BC) ****************************

  2BBC  FIRST TIME ENTRY FLAG
  2BBD  COMMAND FROM PARM LIST
  2BBE  UNIT NUMBER FROM PARM LIST
  2BBF  BUFFER ADDRESS FROM PARM LIST
  2BC1  BLOCK NUMBER FROM PARM LIST
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2BC1
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  2BC2   BIT MAP IMAGE FOR RAM DRIVE

  2BD2   RAMDRIVE VOLUME NAME
  2BD3   'RAM'
  2BD6   ACCESS, ENTRY LENGTH
  2BD8   NUMBER OF ENTRIES
  2BD9   FILE COUNT
  2BDB   BIT MAP BLOCK POINTER
  2BDD   BLOCKS ON DISK

2BDE ************ EXIT TO MAIN MEMORY *********************************

  2BDE   WRITE ENABLE HIGH RAM (BANK1) (C08B)
  2BE5   RESTORE 80STORE STATUS >>2BEA
  2BE7   80STORE WAS ON (C001)
  2BEA   GO AROUND MEMORY USED BY XFER >>03EF
  2BED   LOW-ORDER BYTE AND
  2BEE   HIGH-ORDER BYTE USED BY XFER ROUTINE
  2BEF   RETURN TO $FF44 (NORMAL EXIT)
  2BFB   USE ROM XFER ROUTINE TO DO IT >>C314
  2BFE   TWO BYTES NOT USED

2C00 ******* RAMDRIVE CALLER (RUNS AT $FF00) ************************
           (USED TO CALL MAIN PART OF RAMDRIVE DEVICE
            DRIVER WHICH IS AT $200 IN AUX MEMORY.
            ROUTINE AT $FF62 IS USED TO TRANSFER DATA
            FROM MAIN TO AUX MEM.)

  2C00   ---
  2C03   SAVE ZPAGE STUFF I WILL CLOBBER
  2C05   FROM $3C THRU $47 (FF81)
  2C0D   SAVE $3ED/E THAT XFER ROUTINE WILL CLOBBER (03ED)
  2C16   COMMAND = STATUS?
  2C18   IF SO, SIMPLE EXIT WILL DO >>2C44
  2C1A   ELSE, TOO BIG A COMMAND NUM?
  2C1C   IF SO, ERROR >>2C3B
  2C1E   ELSE, INVERT BITS OF CMD
  2C20   AND SAVE IT
  2C22   FORMAT? >>2C2C
  2C24   NO, CHECK BLOCK NUMBER
  2C28   MUST BE <128 FOR RAMDRIVE
  2C2C   GOING TO $200 IN AUX MEMORY
FF33
  2C38   USE XFER ROUTINE TO GET THERE >>C314

  2C3B   I/O ERROR RETURN CODE
  2C3D   EXIT >>2C41
  2C3F   WRITE PROTECTED RETURN CODE
  2C41   ---
  2C42   ERROR EXIT >>2C47
```

```
ProDOS Relocator -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 2C44
-------------------------------------------------------------------------
ADDR     DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2C44   NORMAL EXIT, RETURN CODE IS 0
  2C47   ---
  2C4B   RESTORE ZERO PAGE (FF81)
  2C53   AND $3ED/E (FF7F)
  2C61    AND EXIT TO CALLER WHEN THRU

2C62 ************ COPY MAIN TO AUX BLOCK ******************************
         (CALLED FROM AUX MEM HANDLER)

FF62
  2C62   WRITE IN AUX 48K (C005)
  2C67   COPY BOTH PAGES OF BLOCK
  2C72   WRITE IN MAIN 48K AGAIN (C004)
  2C77   GO TO $2DA IN AUX MEMORY TO RETURN (03ED)
  2C7C   RETURN TO AUX MEM HANDLER AGAIN >>FF33

2C7F ************ DATA AREA ***************************************

FF7F
  2C7F   SAVE $3ED,$3EE
FF80

FF81
  2C81    ZERO PAGE SAVE AREA

2C8D ************ $2C8D-$2CFF NOT USED *********************************

  2C8D   NOT USED
  2CA0

2D00 ************ START OF PRODOS LOAD IMAGE ***************************

2D00     LOAD IMAGE AT $2D00
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: D700
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

D700    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS MACHINE LANGUAGE INTERFACE   *
          *       THIS CODE IS MOVED INTO HIGH   *
          *       RAM ($DE00-$FEFF) BY THE       *
          *       PRODOS RELOCATOR.              *
          *       IT PERFORMS ALL FILE MANAGEMENT *
          *       AND OTHER SYSTEM FUNCTIONS AND *
          *       SUPPORTS THE HARDWARE IN A     *
          *       DEVICE INDEPENDENT WAY.        *
          *                                      *
          *  VERSION 1.1.1 -- 18 SEP 84          *
          *                                      *
          ****************************************

D700 ********** ZERO PAGE USAGE ***************************************

0040    Pointer to callers parmlist
0041
          -- device driver parmlist --
0042    Command
0043    Unit Number
0044    Buffer Pointer
0045
0046    Block Number
0047
          ----------------------------
0048    I/O Pointer - Index Block or..
0048    pointer into $F600 work buffer or..
0048    caller's pathname buffer pointer
0049
004A    I/O Pointer - Data Block
004B
004C    I/O Pointer - Data Block
004D
004E    I/O Pointer - Caller's Data or..
004E    buffer pointer passed in parmlist or..
004E    old I/O buffer
004F

D700 *********** MLI ERROR CODES ***************************************

0000    No Error
0001    Bad call type
0004    Bad parameter count
0025    Interrupt Table full
0027    I/O Error
0028    No device connected
002B    Write protected
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: D700
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

002E    Volume switched
0040    Invalid pathname syntax
0042    Too many files open
0043    Invalid REF NUM
0044    Nonexistent path
0045    Volume not mounted
0046    File not found
0047    Duplicate file name
0048    Disk full
0049    Volume Directory full
004A    Incompatible ProDOS version
004B    Unsupported file type
004C    End of file
004D    Position past EOF
004E    Access error
0050    File already open
0051    File count bad
0052    Not a ProDOS disk
0053    Bad parameter
0055    VCB overflow
0056    Bad buffer address
0057    Duplicate volume mounted
005A    Bad volume bit map

D700 ********** SCREEN LOCATIONS ***************************************

0750    For direct movement of text to screen
07D0
07F1
07F2
07F3
07F4
07F5
07F6
07F7
07F8    Slot in use

D700 ********** SYSTEM GLOBAL PAGE EQUATES *****************************

BF00    Jump to MLI entry point
BF03    JSPARE (Jump to $EECF, QUIT code)
BF06    DATETIME vector
BF09    Jump to System Error
BF0C    Jump to System Death Handler
BF0F    System Error number
BF10    Device Driver address table
BF30    Slot/Drive last device
BF31    Count (-1) active devices
BF32    List of active devices by DEVID
BF58    Memory BITMAP for low 48K
BF70    Open file 1 buffer address
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: D700
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

BF7E    Open file 8 buffer address
BF80    Interrupt handler 1
BF82    Interrupt handler 2
BF84    Interrupt handler 3
BF86    Interrupt handler 4
BF88    A reg save during interrupt
BF89    X reg save during interrupt
BF8A    Y reg save during interrupt
BF8B    S reg save during interrupt
BF8C    P reg save during interrupt
BF8E    Interrupt return address
BF90    Date/Time
BF94    File open LEVEL
BF95    Backup bit
BF9A    Prefix flag (0 = no prefix)
BF9B    MLI active flag
BF9C    Last MLI call return address
BF9E    MLI X reg savearea
BF9F    MLI Y reg savearea
BFA0    HIGH RAM entry/exit routines
BFD0    Interrupt entry/exit routines
BFF4    Bank switch saved state ($E000 byte)

D700 ********** SOFT SWITCHES ****************************************

C00C    Reset 80 column mode
C051    Set TEXT mode
C053    Set Mixed text/graphics
C054    Display Primary page
C056    Set LORES graphics mode
CFFF    Reset alternate I/O ROMs

D700 ********** PATHNAME - DATA AREA *********************************
          ---------------------------------
          | L1 | NAME1 | L2 | NAME2 | .. | 00
          ---------------------------------
        Prefix is at top of buffer such that a
        negative index may be used to use it,
        wrapping around to the pathname again.

  D700  pathname buffer

D800 ********* FILE CONTROL BLOCKS ***********************************

        FCB0 starts here..
  D800  Reference Number
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: D800
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

        THE FOLLOWING 6 BYTES ARE THE FILE ID
  D801  Device Number
  D802  Dir Block HDR for Dir describing this File
  D804  Dir Block containing entry itself
  D806  File entry # in this Directory

  D807  Storage Type
        Flags
          1XXX XXXX   Index Block Buffer Changed
          X1XX XXXX   Data Block Buffer Changed
          XX1X XXXX   Unused
          XXX1 XXXX   Directory entry needs update
          XXXX 1XXX   Storage Type Changed
          XXXX X1XX   Allocate new Master Index Block
          XXXX XX1X   Allocate new Sub Index Block
  D808  XXXX XXX1   Allocate new Data Block
  D809  Access Byte
  D80A  Newline Character
  D80B  Buffer Number  (REF_NUM * 2)
  D80C  Master Index/Key Block Number
  D80E  Current Index Block
  D810  Current Data Block
  D812  Mark
  D815  End of File
  D818  Blocks Used
  D81A  not used
  D81B  Level
  D81C  Flag - Write occurred if MSB on
  D81D  not used
  D81F  Newline Enable Mask

  D820  FCB1 through FCB7

D900 ********** VOLUME CONTROL BLOCKS ********************************

        VCB0 starts here..
  D900  Length  (0000LLLL)
  D901  File Name (Max 15)
  D910  Unit Number
  D911  Files Open Flag (if $FF)
  D912  Total Blocks
  D914  Blocks Free
  D916  Block Number of Vol Dir Key Block
  D918  not used
  D919  not used
  D91A  Bit Map Pointer
        Block offset into multi-block bitmap of
  D91C  next free bit.
  D91E  Count of open files
```

```
ProDOS MLI -- V1.I.1 -- 18 SEP 84                NEXT OBJECT ADDR: D91E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D92Ø  VCBI through VCB7

DAØØ ********** BITMAP BUFFER ***************************************

  DAØØ  Buffer Ist half

  DBØØ  Buffer 2nd half

DCØØ ********** PRIMARY BUFFER ***************************************
          (Used for several things. VOL DIR HDR is
          mapped into it below)

  DCØØ  Pointer Fields
          *** VOLUME DIRECTORY HEADER ***
  DC04  Type/Length  (TTTTLLLL)
  DC05  Volume Name  (Max I5)
  DCI4  Reserved
  DC1C  Creation Datetime
  DC2Ø  Version
  DC21  Min Version
  DC22  Access Byte
  DC23  Entry Length
  DC24  Entries per Block
  DC25  File Count
  DC27  Bitmap Pointer
  DC29  Total Blocks
  DC2B  (remainder of first page of block)
  DDØØ  (second page of block)
DEØØ ********** MLI MAIN ENTRY POINT ********************************

  DEØØ  Clear decimal mode
  DEØI  Save Registers (BF9F)
  DEØ7  Set ($4Ø) -> Address of function code -I
  DEØB  Set CMDADR -> True return address
  DEIA  Init Global Page System error to Ø (BFØF)
  DEIE  Get Function Code
  DE21  Build hash index into Command Table (X reg)
  DE2A  Is this code valid?
  DE2F  No >>DEA7
  DE32  Set ($4Ø) -> Parameter list
  DE3F  Get parameter count required (FD85)
  DE42  None? >>DE6Ø
  DE44  No - is parameter count correct?
  DE46  No >>DEAB
  DE48  Check class of function (FD65)
  DE4B  Quit?
  DE4D  yes >>DE5D
  DE4F  no,
  DE5Ø  $8X - Calls to I/O Drivers >>DE66
  DE52  $CX/DX - Non System calls >>DE7I
```

```
ProDOS MLI -- V1.1.I -- 18 SEP 84                NEXT OBJECT ADDR: DE54
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  DE54  Else, $4X - Interrupt support
  DE55  Isolate type (DEALLOC = 1, ALLOC = Ø)
  DE57  Call Interrupt Support <DEF3>
  DE5A  Then Exit to Caller >>DE78
  DE5D  Go to quit code via global page >>BFØ3

DE6Ø *************************************************************
          ****** MLI GET_TIME CALL ******
          ******************************

  DE6Ø  Call Date/Time driver <BFØ6>
  DE63  and exit to caller >>DE78

DE66 *************************************************************
          ****** MLI READ_BLOCK CALL *******
          ****** MLI WRITE_BLOCK CALL ******
          ********************************
          $8Ø - Read Block
          $81 - Write Block

  DE66  ---
  DE67  Set $42 -> 1 for READ, 2 for WRITE
  DE6B  Do Block I/O <DEB2>
  DE6E  Then Exit to Caller >>DE78

DE7I ********** $CX and $DX CALLS ***********************************

  DE7I  ---
  DE72  Isolate function Index
  DE75  Perform function and exit to caller <E047>

DE78 ********** EXIT TO CALLER ***************************************

  DE78  Clear Backup
  DE8Ø  Error occurred?
  DE83  Save test results
  DE84  Disable interrupts
  DE85  MLI no longer active (BF9B)
  DE88  Get test results back
  DE89  Store in X reg
  DE8A  Set up Return Address on stack (BF9D)
  DE92  Put test results on stack
  DE94  Put error code in A reg
  DE95  Restore X reg (BF9E)
  DE98  Restore Y reg (BF9F)
  DE9B  Put error code on stack
  DE9C  Get RAM/ROM orientation (BFF4)
  DE9F  Exit via RAM Global Page >>BFAØ
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: DE9F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

DEA2 ********** NO DEVICE CONNECTED **********************************

  DEA2  ---
  DEA4  Call System Error Handler (Global Page) <BF09>

DEA7 ********** BAD SYSTEM CALL NUMBER *******************************

  DEA7  ---
  DEA9  Branch always taken >>DEAD

DEAB ********** BAD PARAMETER COUNT **********************************

  DEAB  ---
  DEAD  Call System Error Handler <DED7>
  DEB0  Exit to Caller >>DE78

DEB2 ********** BLOCK I/O SETUP ***************************************

  DEB2  ---
  DEB4  Save Old Processor Flags
  DEB5  Disable Interrupts
  DEB6  Copy Parameters to $43-$47
  DEBE  Save Starting Buffer Page in $4F
  DEC3  Find last page + 1
  DEC6  Round up if Buffer not page aligned >>DEC9
  DEC9  Is this Memory already in use? <FC9F>
  DECC  Yes, then exit with error >>DED6
  DECE  No, do Block I/O <DEDA>
  DED1  Error? >>DED6
  DED3  No, then exit normally
  DED5  RETURN
  DED6  Error Exit
  DED7  Call System Error Handler <BF09>

DEDA ********** Block I/O *****************************************

  DEDA  ---
  DEDC  Force off unused UNIT bits
  DEE3  Put Drive number in X reg
  DEE7  Put Device Handler Address in Jump Vector (FEF5)
  DEF0  Exit through Device Handler >>FEF5

DEF3 ********** Interrupt Handler **********************************
         ALLOC/DEALLOC

  DEF3  Save Call Type
  DEF5  Which Type?
  DEF6  DEALLOC? >>DF24
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: DEF6
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         ALLOC

  DEF8  ---
  DEFA  Look for empty slot (BF7E)
  DF01  His Address better be non-zero
  DF05  Store Address of His routine in Global Page (BF7E)
  DF0E  And return the position number we used
  DF14  Exit
  DF15  Skip this Vector
  DF17  Last one?
  DF19  No, check another >>DEFA
  DF1B  Yes, Table Full Error
  DF1D  Always taken >>DF21
  DF1F  Bad Parameter Error
  DF21  Call System Error Handler <BF09>

         DEALLOC

  DF24  ---
  DF26  Get Position Number
  DF28  Can't be zero >>DF1F
  DF2C  Or greater than 4 >>DF1F
  DF2F  Make Index into Table from it
  DF32  And zero His Vector (BF7E)
  DF39  Then Exit

DF3A ********** IRQ Handler ****************************************

  DF3A  ---
  DF3C  Save A reg from Monitor (BF88)
  DF3F  And X,Y,S and P (BF89)
  DF49  Is this ROM enhanced? (DFD8)
  DF4C  Yes, skip three pulls >>DF5A
  DF53  And RTI Address (BF8E)
  DF5A  Replace stack to original condition
  DF5E  Save active slot index (DFCE)
  DF61  In bottom half of stack?
  DF64  Yes, pop off 16 bytes and save them
  DF66  ---
  DF6D  Save $FA - $FF (top of zero page)
  DF6F  ---
  DF77  Is there a User Vector #1 (BF81)
  DF7A  No >>DF81
  DF7C  Yes, call it <DFD9>
  DF7F  His interrupt? >>DFA4
  DF81  Is there a User Vector #2 (BF83)
  DF84  No >>DF8B
  DF86  Yes, call it <DFDC>
  DF89  His interrupt? >>DFA4
  DF8B  Is there a User Vector #3 (BF35)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: DF8E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  DF8E  No >>DF95
  DF90  Yes, call it <DFDF>
  DF93  His interrupt? >>DFA4
  DF95  Is there a User Vector #4 (BF87)
  DF98  No >>DF9F
  DF9A  Yes, call it <DFE2>
  DF9D  His interrupt? >>DFA4
  DF9F  Indicate error type I
  DFAI  Call System Death Handler <BF0C>
  DFA4  Interrupt Serviced
  DFA6  Restore zero page (FDF5)
  DFAE  And stack (BF8B)
  DFBE  Is this enhanced ROM? (DFD8)
  DFCI  Yes, skip some stuff we used to have to do >>DFD5
  DFC3  Reload X and Y (BF8A)
  DFC9  Disable I/O ROMS (CFFF)
  DFCC  Replace active slot number (C100)
  DFD5  Exit from Interrupt >>BFD0
  DFD8  ENHANCE FLAG. Set to 1 by RELOCATOR if new type ROM found.
         (That is, if ROM IRQ Vector jumps below $D000)

  DFD9  User Interrupt Handlers (#1 - #4) >>BF80

DFE5 ********** SYSTEM ERROR HANDLER **********************************

  DFE5  Save Error Code (BF0F)
  DFE9  Pop out of subroutine
  DFEA  Exit to caller with Error Code (BF0F)
  DFEE  RETURN

DFEF ********** SYSTEM DEATH HANDLER **********************************

  DFEF  ---
  DFFI  Entry from System Global Page here
  DFF2  Turn off 80 column card (C00C)
  DFF5  Select standard Text display (C051)
  E00I  Blank out a line
  E003  ---
  E008  Print "INSERT SYSTEM DISK AND RESTART" (FE1E)
  E012  Go into infinite loop if no error code >>E044
  E0I6  "-" (07F1)
  E0IB  "E" (07F2)
  E020  "R" (07F3)
  E023  "R" (07F4)
  E027  Convert error code to Hex
  E033  And print it (07F6)
  E037  Second digit also
  E044  Infinite loop >>E044
```

```
ProDOS MLI -- VI.I.1 -- I8 SEP 84                NEXT OBJECT ADDR: E044
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E047 ********** PERFORM FILING OR ************************************
          ******* HOUSEKEEPING FUNCTIONS ******

  E047  Save function index (FEB7)
  E04A  Get INFO flags for this command (FDCD)
  E04D  Times 2
  E04E  Store Command Number times 2 (FEB3)
  E053  And use it to index into Address Table
  E057  Set up Jump Vector with this function's (FEF5)
  E05A  ..handler address (FDA6)
  E060  Signal Backup required after call
  E065  PATHNAME not required? >>E06C
  E067  Required - parse and validity check <E08A>
  E06A  Bad Name? >>E083
  E06C  Reference Number in list? (FEB3)
  E06F  No >>E076
  E07I  Yes - check it out <EID0>
  E074  Bad Number? >>E083
  E076  Date/Time in list? (FEB3)
  E079  No >>E07E
  E07B  Yes - set System date just in case <BF06>
  E07E  Call Function Handler <E087>
  E08I  If no errors then exit >>E086
  E083  Else - call System error handler <BF09>
  E086  Return to caller
  E087  Indirect JUMP to Handler >>FEF5

E08A ********* CHECK CALLER'S PATHNAME  ******************************
          ****** COPY TO MY AREA          ******

  E08A  Set ($48) -> Pathname
  E095  ---
  E099  Assume partial Pathname (FEBC)
  E09C  No Pathname in my area yet (D700)
  E09F  Check length of caller's Pathname
  E0A1  Zero is no good >>E0FB
  E0A5  Nor is 65 or more >>E0FB
  E0A7  Save length (FE9E)
  E0AA  Length + 1 (FE9E)
  E0AE  Get first character of his name
  E0B2  Is it "/"?
  E0B4  No >>E0BA
  E0B6  Yes - indicate fully qualified name (FEBC)
  E0B9  Bump past "/"
  E0BA  ---
  E0BC  Length of Index level is -1 initially (D700)
  E0BF  First character of Index level (counter) (FEB8)
  E0C2  Start of upcoming Index level in name (FEBA)
  E0C5  At end of name yet? (FE9E)
  E0C8  Yes >>E0FF
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E0CA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E0CA  No - get next character in his name
  E0D0  Is it "/"?
  E0D2  Yes >>E114
  E0D4  No - lower case?
  E0D6  No >>E0DA
  E0D8  Yes - force upper case
  E0DA  Copy to my Pathname buffer (D700)
  E0DD  Increment Index level counter (FEB8)
  E0E0  Subsequent characters may be A-Z,0-9 or . >>E0E7
  E0E2  Increment Index level counter (FEB8)
  E0E5  First character must be alphabetic >>E0F3
  E0E7  Is it "."?
  E0E9  Yes - get next character >>E0C5
  E0EB  No - is it special or control character
  E0ED  Yes - Bad Pathname then >>E0FB
  E0EF  Is it numeric?
  E0F1  Yes - get next character >>E0C5
  E0F3  Is it Alphabetic?
  E0F9  If so get next character >>E0C5
  E0FB  Else
  E0FC  Bad Pathname
  E0FE  RETURN
  E0FF  ---
  E101  Any characters in last Index level? (FEB8)
  E104  Yes >>E10A
  E106  No, zero characters in it  (FEB8)
  E109  And toss out last "/"
  E10A  ---
  E10B  Mark end of name with $00 (D700)
  E10E  Name too long? >>E0FB
  E110  No - save final length (FE9E)
  E113  Set X -> 0
  E117  Last Index more than 15 characters?
  E119  Yes - then no good >>E0FB
  E11B  Save output Index (FEBD)
  E11E  Store length of previous Index level (FEBA)
  E121  Just before it in buffer (D700)
  E124  Restore output index (FEBD)
  E127  And continue >>E0BA
  E129  End of Name
  E12A  Fully qualified name? (FEBC)
  E12D  Yes >>E134
  E12F  No - Got a Prefix (BF9A)
  E132  No - error >>E0FB
  E134  Else, okay to exit
```

```
ProDOS ML1 -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E135
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E135 ************************************************************
          ****** ML1 SET_PREFIX CALL ******
          ********************************

  E135  Copy Pathname <E08A>
  E138  It's okay >>E144
  E13A  Check length of Volume name (D700)
  E13F  If zero - no Prefix wanted (BF9A)
  E142  Exit with no error
  E143  RETURN

  E144  Get File entry for last index <E5A3>
  E147  Okay? >>E14D
  E149  Invalid Pathname?
  E14B  No - Out now! >>E18B
  E14D  Sub Directory file? (FE5F)
  E154  No, error >>E189
  E156  Fully qualified path? (FEBC)
  E159  Yes >>E15E
  E15B  No - use old Prefix also (BF9A)
  E15E  ---
  E160  Compute new Prefix Index (FE9E)
  E163  Does new Prefix exceed 64 characters?
  E165  Yes - Bad Path error >>E0FB
  E168  Store new Prefix pointer (BF9A)
  E16E  Set Device Number of Prefix Directory (FE9F)
  E174  Save Keyblock for Prefix Directory (FEA0)
  E17D  Copy Prefix to top of Path buffer (D700)
  E180  (preceded by old Prefix if one exists) (D700)
  E188  Exit normally

  E189  Bad File Type Error
  E18B  ---
  E18C  RETURN

E18D ************************************************************
          ****** ML1 GET_PREFIX CALL ******
          ********************************

  E18D  Set ($4E) -> Data Buffer
  E199  Set Length = 64 (max)
  E1A3  Validity check buffer storage <FC82>
  E1A6  Error? >>E18B
  E1AA  Get Prefix index (BF9A)
  E1AE  No Prefix? - Length = 0 >>E1B4
  E1B0  Complement for length
  E1B4  Store in first byte of buffer
  E1B6  If null Prefix exit >>E1CE
  E1B8  ---
  E1B9  Copy Prefix to caller's buffer replacing (D700)
  E1BC  index level name length bytes with "/"
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E1C6
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E1C6  ---
  E1CA  End it with a "/"
  E1CE  ---
  E1CF  Exit normally

E1D0 ********** VALIDITY CHECK REFERENCE NUMBER **********************
                  (PASSED BY CALLER)

  E1D0  Get Reference Number
  E1D4  If zero then no good >>E231
  E1D8  If > 8 then no good >>E231
  E1DA  Save Reference Number
  E1DB  Multiply by 32
  E1E1  Result gives offset into FCB's (FE92)
  E1E5  Get back Reference Number
  E1E6  File Control Block active this Reference? (D800)
  E1E9  No - Bad Reference Number >>E22C
  E1EB  Get Buffer Number (D80B)
  E1EE  Find Buffer address in Global Page <FC3C>
  E1F4  No Buffer? >>E21D
  E1F6  Buffer okay, save Page Pointer in $48
  E1FA  Second block in $49
  E1FC  Set last Device used in Global Page (D801)
  E202  Finish setting up pointers (FEDD)
  E205  ($4A) -> 1st Block of Buffer (data)
  E207  ($48) -> 2nd Block of Buffer (index)
  E209  ---
  E20A  Search all Volume Control Blocks (D910)
  E20D  for the one which goes with requested unit (D801)
  E212  ---
  E218  Can't find matching Volume Control Block
  E21A  So die with error type $0A <BF0C>
  E21D  No Buffer in open File Control Block
  E21F  So die with error type $0B <BF0C>
  E222  Is Volume mounted? (D900)
  E225  No, keep looking >>E212
  E227  Save Volume Control Block index (FE91)
  E22B  Exit normally

  E22C  ---
  E22E  This looks wrong!!!! (FE92)
  E231  Bad Reference Number error
  E234  RETURN

E235 ***************************************************************
       ****** MLI ONLINE CALL ******
       ****************************
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E235
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E235  Set ($4E) -> Data Buffer <F20D>
  E238  Set Length = 0
  E242  Get Unit Number
  E244  Do all Units? >>E24D
  E246  No, just one
  E248  Set length = 16 (FEDA)
  E24B  Always taken >>E252
  E24D  If all Units
  E24F  Set Length = 256 (maximum) (FEDB)
  E252  Is Buffer in main RAM? <FC82>
  E255  No, then exit >>E28A
  E257  Yes, zero out Buffer
  E25C  ---
  E261  Index into Data Buffer = $00 (FEBA)
  E266  Get Unit Number again
  E268  Isolate valid bits
  E26A  Specific Unit requested? >>E28B
  E26C  No, copy Device List from Global Page <E864>
  E26F  Save Device Count (FEBD)
  E272  Get last Device (FECA)
  E275  Generate return data for it <E28B>
  E278  Bump data buffer index by 16 (FEBA)
  E281  Get next Device (FEBD)
  E285  And go do it >>E26F
  E287  When done, exit
  E28A  RETURN

  E28B  Save Device Number (BF30)
  E28E  Scan for the Volume Control Block <E876>
  E291  Error? >>E2C3
  E293  We need Block 2 (Key Block of VolDir)
  E29B  Read Volume Directory Key Block <EBEE>
  E29E  Error? >>E2C3
  E2A0  Was something already mounted? (FE91)
  E2A6  No >>E2AD
  E2A8  Yes, Files open? (D911)
  E2AB  Yes >>E2B9
  E2AD  No, set up Volume Control Block for new VOL <E8D1>
  E2B0  Error? >>E2C3
  E2B2  No
  E2B4  Was a duplicate Volume Control Block found? (FEB5)
  E2B7  Yes, then error >>E2C3
  E2B9  See if the same Volume is still there (FE91)
  E2BF  If not, Disk Switch Error
  E2C1  Else, all is well - continue >>E2E1
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E2C3
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E2C3 ********** ERROR ************************************************
         Store code in data buffer entry

  E2C3  ---
  E2C4  Store Device Number in entry  <E2F6>
  E2C9  Store error code next
  E2CB  Duplicate Volume error?
  E2CD  No - done >>E2DF
  E2D0  Store Device Number for duplicate next (FEB6)
  E2D8  No Duplicate now
  E2DF  Exit with error
  E2E0  RETURN

E2E1 ********** MAKE ONLINE VOLUME ENTRY ****************************

  E2E1  Get name length for loop index (D900)
  E2EA  Copy name to Buffer entry (D900)
  E2F1  Done yet? (FEB8)
  E2F4  No, do another >>E2EA
  E2F6  Yes, find current Buffer entry (FEBA)
  E2F9  Store Device number (BF30)
  E301  Return to caller

E302 ************************************************************
         ****** MLI CREATE CALL ******
         ****************************

  E302  Follow Path to File <E5B6>
  E305  Error? - I'm expecting one >>E30B
  E307  If File was found - Duplicate error
  E309  ---
  E30A  Return to caller

  E30B  File not found?
  E30D  No, then a real error occurred >>E309
  E30F  Yes, get requested storage type
  E313  Is it 00, $01, $02 or $03?
  E315  Yes, carry on >>E31B
  E317  Is it $0D?
  E319  No, then exit with error >>E32B
  E31B  Get status of this device (BF30)
  E321  Exit on error >>E32E
  E323  Is there a free Directory entry? (FE9B)
  E326  No >>E32F
  E328  Yes - continue >>E3C1
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E328
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E32B  Indicate Bad Storage Type
  E32E  Return to caller

  E32F  Is this the Volume Directory? (FE46)
  E335  No, we can extend it >>E33B
  E337  Yes, indicate Volume Directory Full error
  E33A  Return to caller

          * EXTEND DIRECTORY FILE *

  E33B  Save old current Block number
  E341  Allocate a Block on Disk <EAB6>
  E344  Save the number
  E345  Replace BLKNUM
  E34B  Was there a free Block?
  E34C  No, then exit >>E32E
  E34E  Yes, set up forward pointer in old one (DC02)
  E351  to point to it (DC03)
  E354  and Write old Directory Block <EBEA>
  E357  Error? Yes, then exit >>E32E
  E35B  Set BLKNUM -> new Block number
  E360  Back point to old Directory Block (DC02)
  E366  Loop until done >>E35B
  E36A  Zero remainder of Block Buffer (DC02)
  E36D  (including forward pointer) (DD00)
  E371  Loop until done >>E36A
  E373  Write new Directory Block <EBEA>
  E376  Error? Yes, then exit >>E32E
  E378  Set BLKNUM -> Parent Directory number (FE46)
  E382  Read Block with my entry <EBEE>
  E385  Entry number of my Directory (FE48)
  E388  None relocatable!!
  E38A  Set ($48) -> Buffer
  E38C  Skip link pointers
  E38E  ---
  E38F  Count entries
  E392  Skip to next (FE49)
  E39B  Save LSB
  E39F  Add 1 to Blocks used
  E3A1  and $200 to EOF mark (FDCE)
  E3A4  in entry
  E3AA  Loop until done >>E39F
  E3AC  Write back Block to Parent Directory <EBEA>
  E3AF  Error? then exit >>E3C0
  E3B1  Start all over now that there's room >>E302
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E3B1
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E3B4 ********** ZERO $F600 ****************************************

  E3B4  Zero $F600 Block Buffer
  E3C0  Return to caller

E3C1 ********** BUILD NEW FILE ************************************

  E3C1  Call Zero $F600 routine <E3B4>
  E3C4  Copy Datetime (Creation)
  E3C6  to my variables
  E3D2  Loop until done >>E3C6
  E3D4  Did he give Datetime (Creation)?
  E3D5  Yes, carry on >>E3E2
  E3D7  No, then use
  E3D9  System Datetime instead (BF90)
  E3E2  If Storage type is $00, $01, $02 or $03
  E3E4  force it to $10
  E3EA  else use a $D0
  E3EC  Find File name (FEBA)
  E3EF  OR Storage type to name length (D700)
  E3F2  Store Type/Length (FE5F)
  E3F5  Isolate name length
  E3F9  Copy File name to File Entry Buffer (FEBA)
  E407  Copy caller's Access Byte
          NOTE: This should be validity checked!!!
  E40F  and copy File type
  E414  ---
  E415  and AUX_TYPE
  E41E  Copy Version and Min_Version (0,0) (FDF0)
  E421  constants to entry (FE7B)
  E42A  Indicate 1 Block used
  E42F  Copy Directory Header Block number (FE5A)
  E43E  Is this a Seedling file?
  E440  Yes >>E479
  E442  No, Directory file - Build Header in $F600
  E444  Copy completed Directory entry (FE5F)
  E447  to $F600 buffer first (DC04)
  E44B  Loop until done >>E444
  E44D  Make Storage type $E in Header itself
  E452  Put "HUSTON" (Author) in Reserved area
  E45A  and Version, Min_Version, Access, (FDF0)
  E45D  Entry-length, File count and (DC20)
  E460  Parent pointer from constants
  E461  Loop until done >>E454
  E465  Copy Parent Block entry number (FE5C)
  E46C  Loop until done >>E465
  E46E  Copy Parent entry Length (FE51)
  E476  EOF = $200 (FE75)
  E479  Allocate a new disk block <EAB6>
  E47C  error? >>E4B5
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E47E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E47E  Store it in key pointer of entry (FE70)
  E484  and in BLKNUM for I/O
  E488  Write zeroed (or DIR HDR) key block <EBEA>
  E48B  error? >>E4B5
  E48D  Bump parent's file count (FE53)
  E495  Go update directory <E4B6>
  E498  error? >>E4B5
  E49A  Checkpoint Volume Bit Map and exit  >>EB93

E49D ********** POINT $48/49 AT DIRECTORY ENTRY **********************

  E49D  $48/$49 --> Entry
  E4A1  Skip link pointers (+4)
  E4A3  File entry number counter (FE5E)
  E4A6  ---
  E4A7  Skip to proper entry
  E4AA  Add entry length (FE51)
  E4AF  (bump MSB)
  E4B3  (store LSB)
  E4B5  RETURN

E4B6 ********** UPDATE DIRECTORY(S) **********************************

  E4B6  System date available? (BF90)
  E4B9  no, forget it >>E4C6
  E4BD  yes, copy to last modified date field (BF90)
  E4C6  turn on BUBIT (backup) if appropriate (FE7D)
  E4CF  set DEVNUM of parent (FE59)
  E4D5  and BLKNUM (FE5C)
  E4DF  reread DIR block containing entry <EBEE>
  E4E2  error? >>E4B5
  E4E4  Point to proper entry in buffer <E49D>
  E4EB  Copy constructed entry to buffer (FE5F)
  E4F6  Is this block the DIR HDR block?
  E501  no, write back new entry <EBEA>
  E504  error? >>E4B5
  E510  and then read DIR HDR block <EBEE>
  E513  error? >>E4B5
  E515  in any case..
  E517  copy back update file count to HDR  (FE53)
  E520  and ACCESS byte (with Backup) (FE50)
  E526  write back HDR block <EBEA>
  E529  error? >>E583
  E52B  is this the VOL DIR? (DC04)
  E532  yes, all done -- exit >>E5A1
  E534  no, subdirectory.. (DC27)
  E537  get parent pointer
  E53E  get parent entry no.. (DC29)
  E544  and entry len (DC2A)
  E54A  read parent DIR block <EBEE>
  E54D  error? >>E583
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E54F
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E54F  find entry for this subdirectory <E49D>
  E552  system date available? (BF90)
  E555  no >>E564
  E557  yes,
  E55B  copy system date/time to... (BF90)
  E55E  modified date/time in entry
  E564  write it back <EBEA>
  E567  error? >>E583
  E56B  BLKNUM = HDR block number
  E574  same block we have now?
  E578  yes, go back and date stamp >>E52B
  E57A  no,
  E57E  read HDR block <EBEE>
  E581  and go back to date stamp parent DIR >>E52B
  E583  error? then exit

E584 ********** NOT ProDOS VOLUME ERROR ******************************

  E584  ---
  E587  RETURN

E588 ********** IS THIS ProDOS VOLUME? *******************************

  E588  Does previous block ptr = 0? (DC00)
  E596  no, not a ProDOS volume >>E584
  E598  else, (DC04)
  E59D  does VOL DIR's STORAGE TYPE = $E or $F?
  E59F  no, error >>E584
  E5A1  else, ok
  E5A2  RETURN

E5A3 ********** GET FILE ENTRY ***************************************

  E5A3  follow path to it's end <E5B6>
  E5A6  error? >>E5B5
  E5AB  copy file entry
  E5B3  and exit
  E5B5  RETURN

E5B6 ********** FOLLOW PATH TO A FILE *********************************

  E5B6  get base dir's data <E73A>
  E5B9  error? >>E60D
  E5BB  another subdirectory in the path? >>E5E5
  E5BD  no, at end of path (E635)
  E5C0  $48/$49 --> $F604 (HDR)
  E5C8  copy part of HDR to file entry
  E5D2  File type = $F (Directory) (FDE8)
  E5D5  BLOCK = 2 (FE5F)
  E5D8  No. blocks used = 4
  E5D9  EOF = $800
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E5DD
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E5DD  TYPE = subdirectory ($D0)
  E5E2  return to caller
  E5E4  RETURN

          *** SCAN DIRECTORY FOR FILE ***

  E5E5  indicate no free entry found as yet
  E5EA  signal in HDR block
  E5EB  zero count of names examined
  E5F0  find name in block <E6E3>
  E5F3  got it! >>E65A
  E5F5  not yet, how many entries expected? (FE98)
  E5F8  less entry no. I just searched  (FE97)
  E5FD  more file entries left to search? >>E60F
  E60B  no, directory error
  E60D  ---
  E60E  RETURN

  E60F  yes, update entries left counter (FE98)
  E615  back to first buffer page ($49)
  E617  check next block pointer (DC02)
  E61F  if zero, directory error >>E60B
  E621  BLKNUM = next directory block
  E628  read next block <EBLE>
  E62B  no errors, loop back for more >>E5EB
  E62D  exit if error

          *** NO MORE FILE ENTRIES ***

  E62E  free entry found in directory? (FE9B)
  E631  yes >>E64E
  E633  no, check pointers (DC02)
  E636  is there another block after this one? >>E63D
  E63B  no... >>E64E
  E63D  yes, free entry will be.. (FE5C)
  E646  first in that block
  E64B  indicate free entry available (FE9B)
  E64E  find next index name <E77B>
  E651  exiting with error
  E652  no more indicies in path, file not found >>E657
  E654  else, path not found
  E656  RETURN

  E657  file not found error
  E659  RETURN

          *** FOUND FILE ENTRY ***
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E65A
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E65A  advance to next subdir in path <E774>
  E65D  end -- save entry no. and exit >>E6CB
  E661  get type of entry
  E665  subdir?
  E667  no, bad path then >>E651
  E66B  copy key block no...
  E66D  to BLKNUM
  E670  and to current DIR block no (FE5A)
  E67A  go read key block of subdirectory <EBEE>
  E67D  error? >>E6A3
  E682  new file count (FE98)
  E68B  check minimum version (DC21)
  E68E  too new? >>E6A1
  E696  count bits in reserved field of DIR hdr
  E697  --- >>E69A
  E69A  ---
  E69D  there must be 5 bits on (normally $75)
  E69F  (there are) >>E6A5
  E6A1  or else, incompatible file format
  E6A3  ---
  E6A4  RETURN

  E6A5  copy DIR HDR <E6AB>
  E6A8  and go scan for next level >>E5E5

E6AB ********* COPY DIRECTORY HDR ************************************

  E6AB  Copy:
  E6AD  CREATION, VERSION, MIN_VERS, ACCESS, (DC1C)
  E6B0  ENTRY_LEN, ENTRIES_PER_BLK, FILE_COUNT (FE4A)
  E6B6  volume directory? (DC04)
  E6BD  if so, exit now >>E6CA
  E6C1  else, copy PARENT_POINTER, (DC27)
  E6C4  PARENT_ENTRY_NO., and PARENT_ENTRY_LEN (FE46)
  E6CA  RETURN

E6CB ********* SAVE DIR ENTRY NO. & BLOCK ****************************

  E6CB  compute entry number (FE52)
  E6D4  save it (FE5E)
  E6D9  and the block it's in (FE5C)
  E6E2  exit

E6E3 ********* SEARCH ONE DIR BLOCK FOR FILE *************************

  E6E3  get entries in this block (FE52)
  E6E9  $48/$49 --> first entry (E635)
  E6F0  ---
  E6F2  skip HDR? >>E727
  E6F4  no, non empty entry?
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: E6F8
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  E6F8  yes >>E707
  E6FA  no, do we need one? (FE9B)
  E6FD  no >>E727
  E6FF  yes, remember it <E6CB>
  E702  don't need another one now (FE9B)
  E705  skip to next entry >>E727
  E707  get length of name
  E709  count it (FE97)
  E70C  save it for loop (FEB8)
  E712  same len as we are wanting? (D700)
  E715  no, skip it >>E727
  E717  ---
  E71B  compare names (D700)
  E725  we found it! exit
  E726  RETURN

  E727  skip to next entry (FE9A)
  E72B  end of block? if so, exit >>E726
  E731  bump $48/$49 by entry len
  E738  and go check next >>E6F0

E73A ********* GET DIRECTORY DATA ************************************

  E73A  find base directory <E793>
  E73D  error? >>E792
  E743  zero out my variables (FE46)
  E749  set up device number (BF30)
  E74F  copy DIR HDR to my variables <E6AB>
  E758  copy TOTAL BLOCKS from VCB (D912)
  E75E  copy BIT MAP Pointer from VCB (D91A)
  E764  copy Block No. of this directory (0046)
  E76A  make second copy of file count (FE53)
  E774  advance to next subdir in path <E77B>
  E777  and update index (FEBA)
  E77A  RETURN

E77B ********* ADVANCE TO NEXT DIR NAME ******************************

  E77B  get this DIR's index (FEBA)
  E782  add len of name to move index to next name (FEBA)
  E786  still in prefix portion? >>E78E
  E788  no, now starting caller's path suffix (BF30)
  E78B  save last DEVNUM accessed (FE9F)
  E78E  return with len of next dir in path (D700)
  E792  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E793
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E793 ********* FIND BASE DIRECTORY ***********************************

  E793  ---
  E795  get old PFIXPTR (BF9A)
  E798  fully qualified pathname? (FEBC)
  E79B  no >>E79E
  E79D  yes, no old PFIXPTR anymore
  E79E  save old prefix index (FEBB)
  E7A1  DEVNUM=Ø (BF3Ø)
  E7A4  ---

          *** SCAN VCB'S FOR A MOUNTED VOLUME ***

  E7A6  scan (D9ØØ)
  E7A9  got one >>E7B7
  E7BØ  else, bump to next VCB
  E7B4  no mounted vols? remount them >>E8Ø8

          *** FIND LAST DIR IN PREFIX OR TOL DIR ***

  E7B7  store name length (FEB8)
  E7BA  same name as in pathname? (D7ØØ)
  E7BD  no -- skip it >>E7AB
  E7CB  save VCB index (FE91)
  E7CE  DEVNUM = VCB's unit no. (D91Ø)
  E7D4  BLOCK = 2 (read VOLDIR if no old PFIX)
  E7DC  get old prefix index (FEBB)
  E7DF  ---
  E7EØ  accumulate a new index (FEBA)
  E7E3  no previous prefix? >>E7F5
  E7E6  find last name in prefix (D7ØØ)
  E7EB  read prefix directory instead of vol dir (FEAØ)
  E7F5  read block <EBEE>
  E7F8  error? >>E8ØØ
  E7FA  is this the right directory? <E89E>
  E7FD  no >>E8ØØ
  E7FF  yes -- exit!

          *** IF NOT THERE, REMOUNT ALL VOLS ***
          *** AND CHECK THEM                 ***

  E8ØØ  open files? (FE91)
  E8Ø6  yes, give up now >>E821
  E8Ø8  else, (FEBB)
  E8ØB  put back old prefix length (FEBA)
  E8ØE  copy DVCLST from global page <E864>
  E814  use last device accessed first >>E825
  E816  if none, get last in my device table (BF31)
  E821  volume not found error
  E824  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E824
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E825  ---
  E828  search for device in device table (FECA)
  E83Ø  device not found >>E821
  E832  when found, make it active device (BF3Ø)
  E837  remove it from table (FECA)
  E83A  find its VCB <E876>
  E83D  not found?  >>E863
  E83F  volume mounted there? (FE91)
  E845  no >>E84C
  E847  yes, open files here? (D911)
  E84A  yes, skip it -- get next unit >>E816
  E84C  else,
  E84E  BLKNUM = 2 (vol dir)
  E854  read volume directory <EBEE>
  E857  error? >>E816
  E859  mount volume on VCB <E8C4>
  E85C  error? >>E816
  E85E  is this his chosen volume? <E89E>
  E861  no, try again >>E816
  E863  yes, exit

E864 ********* COPY GLBL DEVLST TO MY TABLE **************************

  E864  start with last device (BF31)
  E867  get a unit number (BF32)
  E86C  copy it to device table (FECA)
  E872  return count of devices (BF31)
  E875  RETURN

E876 ********* SCAN VCB'S FOR DEVICE NO. *****************************

  E876  ---
  E87A  scan VCB's for a given device number
  E881  not it? >>E888
  E883  is it, save VCB index (FE91)
  E886  and exit normally
  E887  RETURN

  E888  else, volume mounted here? (D9ØØ)
  E88B  yes >>E891
  E88E  no, save VCB index to empty unit (FE91)
  E891  ---
  E893  bump to next VCB
  E895  and go look at it >>E87A
  E897  not found...
  E898  any free entries? if not, error >>E89B
  E89A  else, all is well -- return empty VCB
  E89B  VCB table full error
  E89D  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E89D
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E89E ********* COMPARE DIR NAME WITH PATH LVL ************************

  E89E  ---
  E8A3  check DIR type (DC04)
  E8A6  VOL DIR or SUB DIR?
  E8A8  neither >>E8B1
  E8AA  yes..
  E8AC  store len of its name (FEB8)
  E8AF  and go on >>E8B6
  E8B1  error exit
  E8B2  RETURN

  E8B3  compare directory names (DC04)
  E8B9  no match? >>E8B1
  E8C2  they match! exit
  E8C3  RETURN

E8C4 ********* MOUNT NEW VOLUME ***************************************

  E8C4  volume mounted? (FE91)
  E8CA  no, continue >>E8D1
  E8CC  yes, same one as one wanted? <E929>
  E8CF  if so exit, else fall thru >>E928

E8D1 ********* SET UP VCB FROM VOLDIR *********************************

  E8D1  zero out VCB
  E8DC  is this a ProDOS volume? <E588>
  E8DF  no -- exit >>E928
  E8E1  duplicate vol in VCB's? <E94A>
  E8E4  yes -- exit with that one instead >>E927
  E8E6  get new volume's name length (DC04)
  E8ED  add to VCB index (FE91)
  E8F1  and copy to VCB name field in empty VCB (DC04)
  E8FC  store in VCB name len field (D900)
  E8FF  copy DEVNUM to VCB unit field (BF30)
  E905  copy total blocks to VCB (DC29)
  E911  copy block no. of vol dir to VCB
  E91B  copy bit map block no. to VCB (DC27)
  E927  exit
  E928  RETURN

E929 ********* COMPARE VOL NAMES TO MAKE ******************************
          ****** SURE THEY MATCH           ******

  E929  get length (DC04)
  E92E  same in VCB? (D900)
  E931  no >>E941
  E934  yes, add len to VCB index to point at (FE90)
  E937  last char of name in VCB (FE90)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E93E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E93E  compare names (D900)
  E941  SEC if no match
  E948  CLC if match
  E949  RETURN

E94A ********* LOOK FOR DUPLICATE VOL *********************************

  E94A  start with first VCB
  E94C  ---
  E94D  this VCB has same name? <E929>
  E950  no >>E961
  E952  yes, files open? (D911)
  E955  yes >>E96B
  E959  no, mark VCB empty (NAME=0) (D900)
  E95C  (UNIT=0) (D910)
  E95F  and exit with no error >>E969
  E961  else,
  E963  bump to next VCB
  E967  and loop >>E94C
  E969  exit no errors
  E96A  RETURN

  E96B  save flag (FEB5)
  E96E  and VCB index of duplicate vol (FEB6)
  E971  exit with error
  E972  RETURN

E973 ********* SEE IF A QUANTITY OF FREE  *****************************
          ****** BLOCKS IS AVAILABLE ON VOL ******

  E973  any free blocks counted in VCB?  (FE91)
  E97C  yes >>E9D0

          *** COMPUTE VCB FREE BLOCK COUNT ***

  E97E  no, how many bit map blocks are there? <EA22>
  E981  save it (less 1) (FE9C)
  E986  zero scratch (will count free blocks) (FE86)
  E98C  no block found yet
  E991  checkpoint bit map buffer <EB93>
  E994  error? >>E9E4
  E999  BLKNUM = bit map pointer (D91A)
  E9A3  read block to buffer <EBEE>
  E9A6  error? >>E9E4
  E9A8  count free blocks marked <E9E5>
  E9AB  drop no. remaining to do (FE9C)
  E9AE  none left? >>E9B9
  E9B0  some, BLKNUM = BLKNUM + 1
  E9B6  go process that >>E9A3
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: E9B6
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E9B9  did we find a free bit? (FE91)
  E9BF  no -- volume full >>E9E1
  E9C1  save VCB bitmap block offset (D91C)
  E9C4  save free block count in VCB also (FE87)
  E9D0  are there enough to satisfy request? (D914)
  E9DF  yes, exit
  E9E0  RTURN

  E9E1  volume full error
  E9E4  RETURN

E9E5 ********* SCAN AND COUNT BITMAP BLOCKS ***************************

  E9E5  scan through both buffer pages
  E9EC  counting one bits <EA12>
  E9F7  ---
  E9FA  found free block already? (FE9B)
  E9FD  if so -- done >>EA11
  E9FF  any blocks found yet? (FE86)
  EA05  no >>EA11
  EA07  yes, compute total no. of bitmap blocks <EA22>
  EA0B  less number remaining (FE9C)
  EA0E  gives bitmap block with first free bit (FE9B)
  EA11  exit

EA12 ********* COUNT ONE BITS IN A BYTE ********************************

  EA12  shift and...
  EA15  count bits that are on (FE86)
  EA1D  exit when byte goes to zero
  EA21  RETURN

EA22 ********* COMPUTE NO. BITMAP BLKS -1 *****************************

  EA22  get blocks on vol count (-1) (FE91)
  EA2E  ---
  EA2F  isolate top nibble of block count
  EA30  for bit map block count
  EA33  RETURN

EA34 ********* FREE A BLOCK ON DISK ***********************************

  EA34  save MSB (FE9C)
  EA37  and LSB
  EA3B  block number passed too big for (D913)
  EA3E  volume size? (FE9C)
  EA42  yes, error >>EAB2
  EA45  no, get bit position for block no.
  EA4B  save it (FE9B)
  EA4F  divide block no. by 8 (FE9C)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: EA52
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  EA52  giving byte offset as remainder
  EA5B  save byte offset  (FEA2)
  EA5E  make quotient/2 into block index (FE9C)
  EA61  remember which page in that block (FEA4)
  EA64  read bit map block (after checkpoint) <EB64>
  EA67  error? >>EAB1
  EA69  are we at proper block of bitmap yet? (FEA9)
  EA6F  yes! >>EAB7
  EA71  no -- checkpoint <EB93>
  EA74  error? >>EAB1
  EA76  indicate block wanted in VCB (FE9C)
  EA7F  DEVNUM of bitmap (FEA6)
  EA82  read actual block directly <EBA4>
  EA85  error? >>EAB1
  EA87  get byte offset into page (FEA2)
  EABA  which page? (FEA4)
  EA8D  get bit pattern to set (FE9B)
  EA90  page 0? >>EA9A
  EA92  no, turn bit on in page 1 (DB00)
  EA98  and continue >>EAA0
  EA9A  turn bit on in page 0 (DA00)
  EAA0  mark bitmap needs checkpoint
  EAA8  count block freed (FEC2)
  EAB0  exit normally
  EAB1  RETURN

  EAB2  bad bitmap error
  EAB5  RETURN

EAB6 ********* FIND A FREE DISK BLOCK AND ***************************
         ****** AND ALLOCATE IT            ******

  EAB6  go read bitmap <EB64>
  EAB9  error? >>EADE
  EABB  first page 0
  EAC0  scan 1st page of bitmap for free block(s) (DA00)
  EAC8  bump tm page 1 of buffer (FEA4)
  EACB  bump page offset (FEA3)
  EACE  scan 2nd page too (DB00)
  EAD6  bump page (FEA3)
  EAD9  get next block <EB42>
  EADC  continue >>EABB
  EADE  error exit

  EADF  save byte index  (FEA2)
  EAE2  shift combination of page no. and (FEA3)
  EAE5  byte offset left 3 bits to make (FE87)
  EAE8  room for bit position.
  EAF7  depending on buffer page ... (FEA4)
  EAFC  reload bit pattern from page 0... (DB00)
  EB01  or page 1 (DA00)
```

```
ProDOS MLI -- VI.1.I -- I8 SEP 84                NEXT OBJECT ADDR: EB04
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  EB04  shift bit pattern, bumping block no. LSB
  EB05  until a one bit is found >>EB0A
  EB0A  then shift it back the way it was
  EB0B  (with that bit turned off) >>EB0A
  EB0D  store LSB of block no. (FE86)
  EB10  store updated byte back in proper page (FEA4)
  EB1D  indicate bitmap needs checkpoint
  EB25  one less block available in VCB (FE9I)
  EB3A  ---
  EB3B  return with new block no. (FE86)
  EB41  RETURN

EB42 ********* GET NEXT BITMAP BLOCK *********************************

  EB42  use blocks of vol to compute (FE9I)
  EB45  number of blocks in bitmap (D9I3)
  EB4C  just scanned last block? (D91C)
  EB4F  yes, no space >>EB60
  EB5I  no, get next block (D91C)
  EB5A  checkpoint old one <EB93>
  EB5D  go read block  >>EB64

  EB60  disk full error
  EB63  RETURN

EB64 ********* READ BITMAP BLOCK *************************************

  EB64  have we read bitmap for this unit yet? (FE91)
  EB6D  yes >>EB7D
  EB6F  no, checkpoint bitmap of some other unit <EB93>
  EB72  error? >>EB92
  EB77  get new bitmap unit no. (D910)
  EB7D  was bitmap modified? (FEA5)
  EB80  yes >>EB87
  EB82  no, read it <EBA4>
  EB85  error? >>EB92
  EB87  save bitmap block offset times 2 (FE91)
  EB8A  (page number) (D91C)
  EB91  exit
  EB92  RETURN

EB93 ********* CHECKPOINT VOLUME BITMAP ******************************

  EB93  ---
  EB94  needs checkpoint? (FEA5)
  EB97  no >>EB92
  EB99  yes, write it <EBE6>
  EB9C  error? >>EB92
  EB9E  doesn't need checkpoint now
  EBA3  exit
```

```
ProDOS MLI -- VI.I.1 -- I8 SEP 84                NEXT OBJECT ADDR: EBA3
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

EBA4 ********* READ BITMAP *************************************************

  EBA4  save DEVNUM (FEA6)
  EBA7  copy block offset wanted (FE9I)
  EBBI  BITMAP BLOCK = BITMAP PTR + BLOCK OFFSET (D91A)
  EBBF  set up read command

          *** READ OR WRITE BITMAP ***

  EBC1  save I/O command
  EBC7  device = bitmap device (FEA6)
  EBCD  block = bitmap block  (FEA7)
  EBD7  point to bitmap buffer (EA9C)
  EBDA  do the I/O <EBF5>
  EBDF  restore old DEVNUM (BF30)
  EBE2  ok? >>EBE5
  EBE4  no, error exit
  EBE5  RETURN

EBE6 ********* WRITE BITMAP ************************************************

  EBE6  set up write command
  EBE8  and go do it >>EBC1

EBEA ********* WRITE BLOCK *************************************************

  EBEA  set up write command
  EBEC  and go do it >>EBF0

EBEE ********* READ BLOCK **************************************************

  EBEE  set up read command

EBF0 ********* READ OR WRITE BLOCK *****************************************

  EBF0  save I/O command
  EBF2  where is my buffer? (E635)
  EBF5  save flags
  EBF6  and disable
  EBF9  Set low byte of Buffer pointer
  EBFB  to zero
  EBFD  Initialize Global Page System error to 0 (BF0F)
  EC00  set I/O transfer occured flag
  EC05  set unit to do I/O on (BF30)
  EC0A  do block I/O <DEDA>
  EC0D  error? >>EC12
  EC0F  no errors, restore things and exit
  EC11  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: EC11
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  EC12  error exit
  EC14  RETURN

EC15 ******************************************************************
         ****** MLI GET_MARK CALL ******
         ******************************

  EC15  copy mark to caller's list from FCB (FE92)
  EC25  exit with no errors
  EC26  RETURN

  EC27  bad position error
  EC2A  RETURN

EC2B ******************************************************************
         ****** MLI SET_MARK CALL ******
         ******************************

  EC2B  set up to...
  EC33  copy user's mark to temporary
  EC35  new mark variable (FEA8)
  EC3A  make sure it will not exceed EOF (D815)
  EC3F  else, error >>EC27
  EC42  ---

          *** STILL IN SAME DATA BLOCK? ***

  EC48  get old mark (FE92)
  EC4B  find its block no. (*2) (D813)
  EC53  compute distance in pages from old mark's (FEAB)
  EC57  block to new mark (FE86)
  EC5D  earlier -- need new data block >>EC6E
  EC61  too far forward -- need new block >>EC6E
  EC66  MSB's match? (D814)
  EC6B  then mark is still in this block >>ED89

  EC6E  check storage type (D807)
  EC71  zero? >>EC7A
  EC73  seedling, sapling or tree?
  EC77  no, special handling for DIR files >>EDBB

  EC7A  stomp on FCB2's mark??? (F300+$52)
  EC7C  (this should never happen anyway) (D800)
  EC7F  and return with bad REFNUM error
  EC82  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: EC82
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

          *** NEED DIFFERENT DATA BLOCK ***

  EC83  copy storage type (D807)
  EC89  old data block needs writing? (D808)
  EC8E  no >>EC95
  EC90  yes, do so <EE94>
  EC93  error? >>ECFE
  EC95  see if new mark is outside the range of (FE92)
  EC98  the current index block (D814)
  ECA7  yes >>ECC7
  ECAB  yes >>ECC7
  ECAD  no, same index block (FE96)
  ECB0  check storage type
  ECB1  sapling or tree are ok >>ED2D

          *** SEEDLING ***

  ECB3  seedling, check position (FEAB)
  ECB6  if position is outside of block 0..
  ECBA  promote to sapling >>ED1B
  ECBC  else, (D80C)
  ECC4  go get key block (seedling data block) >>ED7F

          *** NEED TO CHANGE DATA BLOCKS ***

  ECC7  does old index block need dumping? (D808)
  ECCC  no >>ECD3
  ECCE  yes, do so <EEA8>
  ECD1  error? >>ECFE
  ECD3  check storage type (FE96)
  ECD6  tree file?
  ECD8  yes >>ED00
  ECDA  no, sapling (FEAC)
  ECDF  is position in first index block?
  ECE2  no, need master index, subindex and data >>ED46
  ECE4  yes, first index, reset flags <EDAF>
  ECE7  is this a seedling?
  ECE8  if so, see if in first block >>ECB3

          *** SAPLING ***

  ECEA  no, sapling, read its only index block  <EE3B>
  ECED  error? >>ECFE
  ECF2  set block no. of index block
  ECFC  and continue below >>ED2D
  ECFE  error exit
  ECFF  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: ECFF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         *** TREE FILE/NEED ANOTHER INDEX BLOCK ***

  ED00  reset flags <EDAF>
  ED03  read master index block <EE3B>
  ED06  error? >>ECFE
  ED08  make index into block from (FEAC)
  ED0B  MSB_of_position/2
  ED11  is there a subindex there?
  ED13  yes! >>ED20
  ED19  no, fall thru to make one

         *** GET NEW INDEX BLOCK ***

  ED1B  need an index and data block
  ED1D  go allocate them >>ED46

  ED20  set up block no. of subindex
  ED28  read it <EE1D>
  ED2B  error? >>ECFE

         *** SAPLING/TREE - THIS INDEX BLOCK ***

  ED2D  make block no. out of position (FEAC)
  ED36  use as an index to examine index block
  ED38  entry
  ED3E  if its zero...
  ED42  need new data block
  ED46  set flags for what to allocate (FE92)
  ED4F  new index block being created?
  ED51  zero data block in any case <ED67>
  ED54  if not index block that's it  >>ED89
  ED56  else,
  ED5D  zero out index block I/O buffer
  ED64  and continue >>ED89

ED67 ********* ZERO OUT DATA BLK I/O BUFFER **************************

  ED67  ---
  ED6A  zero both pages of buffer
  ED71  ---
  ED78  RETURN

ED79 ********* READ FILE DATA BLOCK **********************************

  ED79  set block no. LSB
  ED7B  copy MSB drom index entry
  ED7F  ---
  ED81  read new data block <EE04>
  ED84  error? >>EDAE
  ED86  reset block allocation flags <EDAF>
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: ED86
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         *** GOT DATA BLOCK WANTED ***

  ED89  ---
  ED90  save previous mark in my variables (D812)
  ED96  set new mark in the FCB (FEAA)
  EDA1  ($4A/$4B --> data block buffer)
  EDA3  $4C/$4D --> start of the page in
  EDA5  the data block buffer which contains (FEAB)
  EDA8  the mark.
  EDAE  exit

EDAF ********* RESET BLOCK ALLOC FLAGS ********************************

  EDAF  get flags (FE92)
  EDB5  turn off low 3 bits (allocate no new
  EDB7  blocks to file) (D808)
  EDBA  RETURN

EDBB ********* SET DIR FILE POSITION **********************************

  EDBB  DIR file?
  EDBD  yes! >>EDC4
  EDBF  no, bad storage type error
  EDC1  go to SYSERR <BF09>
  EDC4  else, get page distance (FE86)
  EDC7  make it into blocks (divide by 2)
  EDCE  new position beyond old? (FEAB)
  EDD1  yes >>EDE1
  EDD3  else, use previous mark
  EDD5  copy to BLKNUM <EDEF>
  EDD8  error? >>EDFE
  EDDA  count it (FE9A)
  EDDD  more to skip? >>EDD3
  EDDF  no, got it >>ED89
  EDE1  use next_block pointer in DIR block
  EDE3  copy to BLKNUM <EDEF>
  EDE6  error? >>EDFE
  EDE8  count it (FE9A)
  EDEB  more to skip >>EDE1
  EDED  got it now! >>ED89

         *** COPY LINK TO BLKNUM ***

  EDEF  copy block number link
  EDF1  to BLKNUM
  EDF4  if non zero,
  EDFA  then go read block. >>EE00
  EDFC  else, EOF error
  EDFE  ---
  EDFF  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: EDFF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

EE00 ********* READ FILE BLOCK ***************************************

  EE00  set block number to read
  EE04  store read I/O command
  EE08  read to $48/$49 buffer
  EE0A  read the block <EE61>
  EE0D  error? >>EE1C
  EE12  copy block no. just read to FCB
  EE1C  exit

EE1D ********* READ SUB-INDEX BLOCK *********************************

  EE1D  set read I/O command
  EE21  read to $48/$49 buffer
  EE23  read the block <EE61>
  EE26  error? >>EE36
  EE2B  save BLKNUM in FCB as current index
  EE2D  block. (D80E)
  EE36  exit

EE37 ********* WRITE KEY INDEX BLOCK *********************************

  EE37  set write I/O command
  EE39  and go do the I/O >>EE3D

EE3B ********* READ KEY INDEX BLOCK **********************************

  EE3B  set read I/O command
  EE3D  common code, save command
  EE40  block no. is key block in FCB (FE92)
  EE45  use $48/$49 buffer

          *** I/O BLOCK ***

  EE47  set I/O command
  EE49  and block no. (D800)
  EE53  must be non-zero block number
  EE57  or horrible death!
  EE5C  fall through to read/write block (D801)

          *** SET UP AND DO FILE BLOCK I/O ***

  EE61  (xreg = buff ptr in zero page)
  EE62  disable
  EE63  set up buffer pointer
  EE6E  get DEVNUM from FCB (D801)
  EE74  set I/O transfer has occurred flag
  EE79  set unit no. from DEVNUM (BF30)
  EE7E  no errors have occurred yet
  EE83  do block I/O  <DEDA>
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: EE86
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  EE86  error? >>EE8B
  EE88  no, exit normally
  EE8A  RETURN

  EE8B  else, exit with error
  EE8D  RETURN

EE8E ********* CHECKPOINT BITMAP & KEY BLOCK *************************

  EE8E  checkpoint bitmap buffer <EB93>
  EE91  go write key block for file >>EE37

EE94 ********* CHECKPOINT DATA BLOCK BUFFER **************************

  EE94  buffer pointer at $4A/$4B
  EE96  point to block no. in FCB
  EE9E  go write buffer to disk <EE47>
  EEA1  error? >>EEC5
  EEA5  go turn off $40 flag in FCB and exit >>EEBC

EEA8 ********* CHECKPOINT INDEX BLOCK BUFFER *************************

  EEA8  checkpoint volume bitmap <EB93>
  EEAB  use $48/$49 buffer
  EEAD  block no. is current index block in FCB
  EEB3  set to write
  EEB5  go write it to disk <EE47>
  EEB8  error? >>EEC5
  EEBA  no longer needs checkpoint
  EEBC  set flags accordingly (FE92)
  EEC5  and exit

EEC6 ************************************************************
          ****** MLI OPEN CALL ******
          **************************

  EEC6  search path for file <E5A3>
  EEC9  found it? >>EECF
  EECB  no, bad path error
  EECD  exit >>EED6
  EECF  else, see if FCB already open on file <EFB3>
  EED2  for write. if not, continue. >>EED8
  EED4  else, file already open error
  EED6  ---
  EED7  RETURN

  EED8  get FCB index  (FE92)
  EEDE  free FCB found? >>EEE4
  EEE0  no, all FCB's in use error
  EEE3  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: EEE3
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  EEE4  zero out unused FCB
  EEEF  copy file ID fields to FCB
  EEF2  (DEVNUM, DIR HDR BLK, DIR BLK, (FE92)
  EEF5  DIR ENTRY NO.)
  EF00  isolate storage type (FE5F)
  EF08  and copy to FCB (D807)
  EF0B  get access (FE7D)
  EF10  DIR file?
  EF12  no >>EF16
  EF14  yes, we are only reading (I hope)
  EF16  update access flag in FCB (D809)
  EF1B  write protected? >>EF22
  EF1D  no, another FCB open on this file? (FE97)
  EF20  yes, no touchie >>EED4
  EF22  This line left over from version 1.0.11 (FE7C)
  EF27  Now always jumps over error exit. >>EF2D
  EF29  if bad, unsupported version error
  EF2C  RETURN

  EF2D  storage type must be < $4
  EF31  or equal to $D
  EF33  else, compatibility error >>EF29
  EF35  ---
  EF37  copy key block, blocks used, and
  EF39  EOF mark to FCB (FE92)
  EF49  BLKNUM = key block number
  EF4E  store REFNUM in FCB (FE9A)
  EF54  go check and assign I/O buffer <FBED>
  EF57  error? >>EF7D
  EF59  go find VCB and set buff ptrs <E1EB>
  EF5C  set current level in FCB (BF94)
  EF62  seedling, sapling or tree? (D807)
  EF67  no, skip next stuff >>EF94
  EF69  yes, make current mark in FCB outside
  EF6B  first index block to force a read of all (D814)
  EF6E  index blocks and BLOCK 0.
  EF72  zero mark wanted, however (FEAA)
  EF78  go set mark to zero <EC48>
  EF7B  ok? >>EF99
  EF7D  no, save the error code
  EF81  got and I/O buffer? (D80B)
  EF84  no >>EF8C
  EF86  yes, free it <FC4A>
  EF8C  mark FCB not in use
  EF92  exit with error
  EF93  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: EF93
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  EF94  else, read key block to I/O buffer <EE04>
  EF97  error? >>EF7D
  EF99  bump open file count in VCB (FE91)
  EF9F  indicate files are open in VCB (D911)
  EFA7  put REF NUM in caller's parmlist (FE92)
  EFB1  exit with no errors
  EFB2  RETURN

EFB3 ********* FIND A FCB ***************************************************

  EFB3  clear flags and index byte
  EFBE  ---
  EFBF  found a free FCB yet? (FE93)
  EFC2  yes >>EFC7
  EFC4  no, bump entry count (FE9A)
  EFC7  FCB in use? (D800)
  EFCA  yes >>EFD9
  EFCC  no,
  EFCF  save index to free FCB  (FE92)
  EFD2  flag that we found one
  EFD7  and skip this FCB >>EFF7
  EFD9  ---
  EFDF  compare file ID's to see if this FCB (D8J0)
  EFE2  is open on the requested file. (FE58)
  EFE5  no match? >>EFF7
  EFEB  indicate FCB already open on file (FE97)
  EFEE  write enabled? (D809)
  EFF3  if not, allow multiple open access to file >>EFF7
  EFF5  else, error exit
  EFF6  RETURN

  EFF7  return index to start of FCB
  EFFB  bump to next FCB
  EFFD  and loop >>EFBE
  EFFF  when done, exit normally
  F000  RETURN

F001 ************************************************************************
          ****** MLI READ CALL ******
          **************************

  F001  point to data buffer <F20D>
  F004  copy request length <F1F2>
  F007  save access
  F008  set up marks <F21F>
  F00C  read access permitted?
  F00E  yes >>F014
  F010  no, access error
  F014  will we read past EOF? >>F03B
  F016  yes, (FE92)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: F019
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  F019  LENGTH = EOF - current_mark (D815)
  F031  are we already at EOF? (FEDA)
  F034  no >>F046
  F036  yes, EOF error

  F03B  else, zero length request? (FEDA)
  F041  no >>F046
  F043  yes, set mark and exit  >>F0F9

  F046  validity check data buffer <FC82>
  F049  no good? >>F038
  F04B  ok, get storage type for file <F218>
  F04E  standard kind of file?
  F050  yes >>F055
  F052  no, DIR file >>F1BB

  F055  else, set mark (to read proper buffers) <EC48>
  F058  error? >>F038
  F05A  set up buffer indexing <F110>
  F05D  move all that can be moved out of data buff <F13A>
  F060  newline or len=0: exit now! >>F043
  F062  newline enabled? continue block by block >>F055
  F064  at least 1 block's worth left to be read? (FEAE)
  F068  if not, never mind >>F055
  F06A  if so, store block count wanted (FEAF)
  F06D  get FCB flags <F606>
  F070  data block modified?
  F072  yes, continue block by block for now >>F055

          *** FAST DIRECT READ ROUTINE ***

  F074  signal no read occurred yet (FEB2)
  F077  read directly into caller's data buffer
  F07F  set mark/read data block to caller's buff <EC48>
  F082  error? >>F0ED
  F084  bump buffer pointer to next location
  F088  drop length remaining by 512 bytes (FEAE)
  F08E  bump mark (FEAB)
  F096  and mark's MSB as necessary (FEAC)
  F099  check if we are out of index block (FEAC)
  F09F  drop counter of multi-blocks (FEAF)
  F0A2  and keep on >>F0B1
  F0A4  end of multi-block read, put ptrs back <F1AD>
  F0A7  more to read? (FEAD)
  F0AD  no, exit through finish-up >>F0F9
  F0AF  yes, conventional block by block read then >>F055
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: F0AF
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  F0B1  crossed index block? go do set mark >>F07F
  F0B3  make index block offset from mark (FEAC)
  F0BC  BLKNUM = next block in index block
  F0C2  zero entry?
  F0CA  if so, no direct read can occur until next (FEB2)
  F0CD  set-mark/read >>F0D2
  F0CF  get MSB of BLKNUM
  F0D2  (put index ptr back)
  F0D6  finish setting BLKNUM MSB
  F0D8  if no read occurred within setmark, (FEB2)
  F0DB  go back to setmark call >>F07F
  F0DF  disable
  F0E0  do I/O to caller's buffer directly
  F0E4  do block I/O directly <DEDA>
  F0E7  error? >>F0EC
  F0EA  go back for more >>F084

          *** ERROR CLEANUP ***

  F0EC  ---
  F0ED  ---
  F0EE  set buffer ptrs/VCB <F1AD>
  F0F2  ---
  F0F3  finish up I/O <F0F9>
  F0F7  exit with error
  F0F8  RETURN

F0F9 ********* I/O FINISH UP ***************************************

  F0F9  ---
  F0FC  return actual length read in caller's list (FEDA)
  F10D  and exit by setting new mark >>EC48

F110 ********* SET UP BUFFER INDEXING *******************************

  F110  ---
  F114  back up pointer to data buffer by an
  F116  amount equal to the LSB of the mark (FEAA)
  F119  (which makes indexing easier)
  F11F  newline mode enabled? (D81F)
  F123  no, CLC >>F12F
  F125  yes, SEC
  F126  copy newline mask (FEB1)
  F129  and newline character (D80A)
  F12F  first char index is LSB of mark in YREG (FEAA)
  F132  $4C/$4D --> page containing mark
  F136  request count LSB in XREG (FEAD)
  F139  exit
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F139
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

F13A ********* COPY FROM I/O BLOCK BUFF ******************************
         ****** TO DATA BUFFER            ******
         EXITS IF:   LENGTH GOES TO ZERO
                     NEXT BLOCK IS NEEDED
                     NEWLINE IS FOUND
         ON EXIT: OVERFLOW FLAG SET IF DONE
                  OVERFLOW ZERO IF NEXT BLOCK NEEDED

  F13A  ---
  F13B  partial page to move? >>F145
  F13D  no, any full pages left? (FEAE)
  F140  no, read complete >>F194
  F142  yes, drop MSB of request length (FEAE)
  F145  ---
  F146  copy one byte $4C --> $4E
  F14B  end of requested chunk? >>F168
  F14D  no, newline enabled? >>F17D
  F14F  ---
  F151  no, loop for more >>F146
  F153  end of page, bump pointers
  F157  bump new mark (FEAB)
  F15F  finished first page of block buffer?
  F163  if so, continue >>F146
  F166  no, need another block from disk >>F197
  F168  another page in request length? (FEAE)
  F16B  no >>F187
  F16E  more in this block-page? >>F176
  F170  no, on last page of block?
  F174  no >>F179
  F176  yes, drop request len by one page (FEAE)
  F179  back up to next byte again
  F17A  go copy next page >>F14D

  F17D  check for newline
  F185  not it, never mind! >>F14F
  F187  else, were we done with page?
  F188  no >>F194
  F18A  yes, bump pointer
  F18C  and mark (FEAB)
  F194  set overflow flag (read completed) (F1AC)

  F197  update mark LSB (FEAA)
  F19C  bump request count if necessary
  F19D  update count LSB (FEAD)
  F1A3  point beyond data in caller's buffer
  F1AB  ---
  F1AC  and exit
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F1AC
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

F1AD ********* CLEANUP AFTER DIRECT I/O *******************************

  F1AD  restore caller's data buffer pointer
  F1B8  go set buffers/find VCB and exit >>E1EB

F1BB ********* DIRECTORY FILE READ ***********************************

  F1BB  set mark/read <EC48>
  F1BE  error? >>F1EF
  F1C0  set up buffer indexing <F110>
  F1C3  move data from I/O buffer <F13A>
  F1C6  need next block? >>F1BB
  F1C8  no, finish up I/O <F0F9>
  F1CB  ok? exit >>F1ED
  F1CD  not ok. EOF error?
  F1D0  no, out now >>F1EE
  F1D2  yes, point beyond EOF anyway? <ED89>
  F1D5  zero out data block I/O buffer <ED67>
  F1DD  dummy up an empty DIR block with previous (D810)
  F1E0  pointer and no forward pointer in I/O
  F1E2  buffer.
  F1E4  zero out current block no. (D810)
  F1ED  return to caller
  F1EE  RETURN

  F1EF  finish up and error exit >>F0F2

F1F2 ********* COPY CALLER'S I/O LENGTH *******************************

  F1F2  copy request length to LENGTH and
  F1F4  a temporary variable
  F205  pick up ACCESS flcgs for file (FE92)
  F20B  exit to caller
  F20C  RETURN

F20D ********* POINT $4E/$4F TO CALLER'S *******************************
         ****** DATA BUFFER                ******

  F20D  set up pointer
  F218  YREG --> FCB (FE92)
  F21B  AREG = storage type (D807)
  F21E  exit

F21F ********* COPY FILE MARK AND COMPUTE *******************************
         ****** AND COMPARE END MARK       ******
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F21F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F21F  ---
  F225  copy file mark (D812)
  F22B  and set previous mark also (FE8D)
  F22E  add length giving new mark in scratch area (FEDA)
  F235  (3 byte addition)
  F23D  will new mark exceed EOF? (FE86)
  F24B  return with carry set accordingly

F24C ********* SET NEW MARK & EOF ***********************************

  F24C  set up indexes <F27E>
  F24F  set new EOF in FCB (FE8A)
  F255  and new mark (FE8D)
  F25B  save new mark in scratch variable too (FE86)
  F262  does mark exceed EOF? <F27E>
  F265  if so, we must extend EOF <F23D>
  F26B  save old EOF (D815)
  F273  set new EOF to mark if necessary (FE86)
  F279  ---
  F27D  exit

  F27E  subroutine to set 3 byte indexes
  F285  RETURN

F286 ************************************************************
          ****** MLI WRITE CALL ******
          ****************************

  F286  copy request length <F1F2>
  F28A  copy file mark <F21F>
  F28D  extend EOF if needed <F268>
  F291  write access enabled?
  F293  yes >>F299
  F295  no, access error
  F299  check status of this device <F458>
  F29C  error? >>F2D9
  F29E  request length = Ø? (FEDA)
  F2A4  no >>F2A9
  F2A6  yes, exit through finish-up >>FØF9

  F2A9  find caller's data buffer <F2ØD>
  F2AC  check storage type
  F2AE  if DIR file, error >>F295
  F2BØ  set mark/read blocks <EC48>
  F2B3  error? >>F2D9
  F2B5  get FCB flags <F6Ø6>
  F2B8  any new blocks needed?
  F2BA  no >>F31E
  F2BC  yes, allocating them
  F2BE  ---
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F2BF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F2BF  count number of blocks needed
  F2C2  store number needed (FE94)
  F2C8  see if the blocks are available <E973>
  F2CB  no, disk full >>F2D9
  F2CD  yes, get FCB flags  <F6Ø6>
  F2DØ  master index block needed?
  F2D2  no >>F2E1
  F2D4  yes, go add it <F399>
  F2D7  and go on if no errors >>F2ED

  F2D9  error,
  F2DA  set new mark/EOF <F24C>
  F2DE  and finish I/O, exit with error >>FØF2

  F2E1  check FCB flags again <F6Ø6>
  F2E4  need sub-index block?
  F2E6  no >>F2ED
  F2E8  yes, go do it <F3E4>
  F2EB  error? >>F2D9
  F2ED  buy a new block for data <F438>
  F2FØ  error? >>F2D9
  F2F2  get FCB flags <F6Ø6>
  F2F5  indicate index buffer changed
  F2F7  no new blocks needed now
  F2F9  update FCB dlags (D8Ø8)
  F2FF  make index block offset from mark
  F3Ø7  store new block no. in index block (FE87)
  F314  and store it as current data block (FE92)
  F31E  set up buffer indexing <F11Ø>
  F321  start writing <F329>
  F324  go see if more blocks are needed >>F2BØ
  F326  I/O finish up when done >>FØF9

F329 ********* COPY WRITE DATA TO I/O BLOCK **************************

  F329  ---
  F32C  lower request count by 1 (FEAE)
  F334  ---
  F335  copy partial page from caller's data
  F337  to I/O block buffer
  F33C  ---
  F33F  next page in caller's area
  F343  bump mark by $1ØØ (FEAB)
  F34B  still in same I/O block page?
  F34F  yes >>F334
  F352  no, clear overflow (I/O incomplete) >>F379
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                    NEXT OBJECT ADDR: F352
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F354  any complete pages left to write? (FEAE)
  F357  no >>F369
  F359  yes, more in this page?
  F35A  yes >>F362
  F35C  no, first block-page?
  F360  no >>F365
  F362  yes, one less complete page to do (FEAE)
  F365  readjust index
  F366  continue with full page >>F33C

  F369  ---
  F36A  a few bytes left to write? >>F376
  F36C  no, bump data buffer by $100
  F36E  and mark (FEAB)
  F376  set overflow (I/O complete) (F1AC)
  F379  store LSB of mark (FEAA)
  F37C  and of request count (FEAD)
  F380  indicate data block modifed <F606>
  F383  and DIR entry needs update
  F389  advance pointer into caller's buffer (FEAA)
  F394  set FCB flag to indicate write occurred <FA66>
  F398  exit

F399 ********* ADD NEW MASTER INDEX BLOCK ****************************
          (MAKE A TREE FILE)

  F399  add higher level <F3F1>
  F39C  error? >>F3F0
  F39E  get storage type <F218>
  F3A1  tree?
  F3A3  yes >>F3AA
  F3A5  no, add another level <F3F1>
  F3A8  error? >>F3F0
  F3AA  buy another block <F438>
  F3AD  error? >>F3F0
  F3AF  maie offset into current index block (FEAC)
  F3B2  from current mark
  F3B4  point index to new block (FE86)
  F3C3  also save as current data block (FE92)
  F3CD  checkpoint bitmap & key block <EE8E>
  F3D0  error? >>F3F0
  F3D5  zero out new index block
  F3DC  ---
  F3E3  and exit
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                    NEXT OBJECT ADDR: F3E4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F3E4 ********* ADD NEW INDEX BLOCK ***********************************

  F3E4  check storage type <F218>
  F3E9  seedling? >>F3F1
  F3EB  no, read key index block <EE3B>
  F3EE  and go add data block >>F3AA
  F3F0  exit if error occurs

          *** ADD A HIGHER INDEX LEVEL TO FILE ***

  F3F1  buy a block <F438>
  F3F4  error? >>F437
  F3F9  save old key block number (D80C)
  F401  make new block the key block (D80C)
  F40E  and current index block in FCB (D80F)
  F417  store pointer to old key block
  F41A  in first position of new index
  F421  checkpoint bitmap and new key block <EE8E>
  F424  error? >>F437
  F426  get storage type <F21B>
  F42B  upgrade it to next higher type (D807)
  F42E  indicate DIR entry needs update  (DB08)
  F437  exit

F438 ********* BUY A DISK BLOCK ***************************************

  F438  allocate a disk block <EAB6>
  F43B  error? >>F457
  F43D  get FCB flags <F606>
  F440  indicate DIR entry needs update
  F449  add 1 to blocks in use for file
  F456  ---
  F457  exit

F458 ********* DO STATUS IF NO I/O YET ********************************

  F458  get FCB flags <F606>
  F45B  any buffers in use? (I/O activity)
  F45D  if so, assume its ok >>F456
  F45F  no, (DB01)
  F462  select new device (BF30)

          *** STATUS CALL ***

  F465  Save Unit Number
  F467  Save Block Number on stack
  F46D  Indicate Status call
  F471  Indicate Block 0
  F475  Go do I/O <DEDA>
  F478   Restore Block Number to original value
  F480   Exit
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: F481
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

F481 ****************************************************************
         ****** MLI CLOSE CALL ******
         ****************************

  F481  check REF NUM
  F485  specific close?  >>F4BC

          *** CLOSE ALL OPEN FILES ***

  F487  no errors yet (FEBE)
  F48C  store FCB index (FE92)
  F490  get its level (D81B)
  F493  if below system LEVEL, skip it (BF94)
  F496  yes, skip it >>F4AD
  F498  no, active FCB? (D800)
  F49B  no >>F4AD
  F49D  yes, flush it and update directory <F51E>
  F4A0  error? >>F4EF
  F4A2  no, close specific FCB <F4C1>
  F4A7  is this a close-all?
  F4A9  yes, ignore errors >>F4AD
  F4AB  no, stop on error >>F4EF
  F4AD  bump FCB index to ngxt one (FE92)
  F4B3  and continue >>F48C
  F4B5  when done, load error number (FEBE)
  F4BB  and exit

          *** CLOSE SPECIFIC FILE ***

  F4BC  flush it <F526>
  F4BF  error? >>F4EF
  F4C1  get buffer number (FE92)
  F4C7  free its pages <FC4A>
  F4CA  error? >>F4EF
  F4CC  release FCB
  F4D4  set DEVNUM (D801)
  F4DA  find VCB for device <E876>
  F4DD  decrement count of open files in VCB (FE91)
  F4E3  some are open... >>F4ED
  F4E5  if all are closed, turn off (D911)
  F4E8  "files open" flag
  F4ED  ---
  F4EE  exit

  F4EF  jump to handle close error >>F5F7
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: F4EF
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

F4F2 ****************************************************************
         ****** MLI FLUSH CALL ******
         ****************************

  F4F2  flush specific file?
  F4F6  yes  >>F526
  F4F8  no, clear flush-all error code (FEBE)
  F4FB  do all FCBs
  F4FD  set FCB index for next FCB (FE92)
  F501  is this file open? (D800)
  F504  no >>F50B
  F506  yes, flush it <F51E>
  F509  error? >>F51B
  F50B  bump to next FCB (FE92)
  F511  and go flush it too >>F4FD
  F513  ---
  F514  return with error code if any (FEBE)
  F51A  RETURN

  F51B  ---

F51E ********** FLUSH A FILE & UPDATE DIRECTORY **********************

  F51E  find buffer/VCB <E1EB>
  F521  no error? >>F530
  F523  error - exit >>F5F7

  F526  zero out close-all error
  F52B  validity check REF NUM <E1D0>
  F52E  error? >>F51B
  F530  is write access allowed? (D809)
  F535  no, exit >>F513
  F537  has a write occured since last flush? (D81C)
  F53A  yes >>F543
  F53C  no, <F606>
  F53F  does anything need flushing anyway?
  F541  no, then exit now >>F513
  F543  else, get FCB flags <F606>
  F546  has data buffer changed?
  F548  no >>F54F
  F54A  yes, checkpoint it <EE94>
  F54D  error? >>F51B
  F54F  get flags again <F606>
  F552  has index buffer changed?
  F554  nm >>F55B
  F556  yes, checkpoint it <EEA8>
  F559  error? >>F51B
  F55B  ---
  F562  copy file identifier data to my variables (D800)
  F56C  set DEVNUM (BF30)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F56F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F56F  BLKNUM = current DIR block (FE5A)
  F579  read DIR block <EBEE>
  F57C  error? >>F51B
  F57E  copy directory header <E6AB>
  F581  are we in block with this file's entry? (FE5C)
  F58A  no >>F591
  F58F  yes >>F598
  F591  no, set new block number
  F595  read it <EBEE>
  F598  point at directory entry in block <E49D>
  F59B  copy file entry from directory <E5A8>
  F5A1  copy blocks_used count to entry (D818)
  F5AF  copy new EOF (D815)
  F5BA  and new key block no. (D80C)
  F5C3  isolate new storage type (D805)
  F5CD  combine it with name length (FE5F)
  F5D5  and update type/len field in entry (FE5F)
  F5D8  write entry back to directory <E4B6>
  F5DB  error? >>F5F7
  F5E0  turn off "write occurred" flag (D81C)
  F5E8  same bitmap in memory (FE59)
  F5EE  no, exit now >>F5F5
  F5F0  yes, checkpoint it also <EB93>
  F5F5  no errors, exit
  F5F6  RETURN

F5F7 ********** CLOSE ERROR ****************************************

  F5F7  is this a close or flush all?
  F5FC  no >>F604
  F600  yes, save error code (FEBE)
  F603  RETURN

  F604  else, real error right now
  F605  RETURN

F606 ********** GET FCB FLAGS *************************************

  F606  load FCB flags (FE92)
  F609  from FCB (D808)
  F60C  and exit

F60D ********** FILE ACCESS ERROR **********************************

  F60D  exit with file access error code
  F610  RETURN
```

```
ProDOS ML1 -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F610
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F611 ************************************************************
          ****** MLI SET_EOF CALL ******
          ******************************

  F611  get storage type <F218>
  F614  if DIR file...
  F616  its an access error >>F60D
  F618  else, save type for truncate to
  F619  mess with.
  F61F  write access permitted? (D809)
  F624  no, error >>F60D
  F626  check device status <F458>
  F629  error? >>F60D
  F632  copy EOF from FCB (D815)
  F640  copy caller's new EOF
  F64B  compare old EOF to new (FE8A)
  F651  if less than or equal to... >>F658
  F653  if greater... >>F66D

          *** OLD EOF <= NEW EOF ***
          *** NO TRUNCATE NEEDED ***

  F658  new eof beyond old
  F65F  copy caller's EOF to FCB
  F66A  exit by indicating flush needed >>FA66

          *** OLD EOF > NEW EOF ***
          (** TRUNCATE FILE     ***

  F66D  flush first <F526>
  F670  error? >>F610
  F672  $43/$49 --> end of data block 1/O buffer
  F67C  compare current mark to new EOF (FE92)
  F689  it is prior to EOF >>F6A2
  F691  if past EOF, force mark back to EOF (FE92)
  F6A2  construct EOF block number and (FEAA)
  F6A5  byte offset into block from new (FEC6)
  F6A8  EOF mark. (FEAB)
  F6C0  on a block boundary? (FEC7)
  F6C3  yes  >>F6E2
  F6C5  no, (FEC5)
  F6C9  decrement block by 1
  F6D7  but don't let it fall below 0
  F6E2  copy key block number (FE92)
  F6F1  set blocks freed to zero
  F6F9  truncate file at new EOF <FA78>
  F6FC  save status
  F704  set new key block in FCB (FEBF)
  F70A  drop FCB block count by number (D818)
  F70D  of blocks freed in truncate routine. (FEC2)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F71A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F71A  copy new storage type (FEC1)
  F727  turn off all block allocation flags <EDAF>
  F72A  update VCB free block count <F9F3>
  F734  copy mark (D812)
  F73C  force current mark to infinity (D812)
  F743  go set mark <EC48>
  F746  no errors? >>F74F
  F748  if error, indicate in saved status
  F74E  but continue
  F74F  copy caller's EOF to FCB <F658>
  F752  Flush and update <F526>
  F755  no errors? >>F75E
  F757  if error, indicate in saved status
  F75D  but continue
  F75E  ---
  F760  exit

F761 ********************************************************************
       ****** MLI GET_EOF CALL ******
       ******************************

  F761  ---
  F766  copy EOF to caller's list (D815)
  F772  exit -- no errors

F773 ********************************************************************
       ****** MLI NEW_LINE CALL ******
       ******************************

  F773  ---
  F775  copy newline mask
  F77E  and newline character
  F784  return, no errors

F785 ********************************************************************
       ****** MLI GET FILE INFO CALL ******
       ***********************************

  F785  get the file entry <E5A3>
  F788  ok? >>F7CC
  F78A  no, bad path?
  F78D  no, real error  >>F7E9
  F78F  else, make it VOL DIR type
  F791  with name length = 0 (FE5F)
  F796  no free blocks needed (FE94)
  F79C  go through the motions to update the (FE91)
  F79F  VCB block count. <E97E>
  F7A5  copy blocks free from VCB (D915)
  F7B1  copy total blocks on volume to AUX_ID (D913)
  F7BF  total - free = blocks_used (FE94)
  F7CC  shift type down from high nibble (FE5F)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F7D8
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F7D8  copy the data to caller's parmlist (FE0C)
  F7E9  and exit

F7EA ********************************************************************
       ****** MLI SET FILE INFO CALL ******
       ***********************************

  F7EA  get the file entry <E5A3>
  F7ED  error? >>F814
  F7EF  indicate backup needed now (BF95)
  F7FE  copy 13 parms from caller's list to (FE0C)
  F801  file entry staging area >>F808
  F808  ---
  F80D  if any spurious access bits are on...
  F811  access error!
  F814  RETURN

  F815  else, anything in his modification date?
  F819  no >>F81E
  F81B  yes, go update directory >>E4C6

  F81E  no, use system date then update directory >>E4B6

F821 ********************************************************************
       ****** MLI RENAME CALL ******
       ****************************

  F821  follow path to file <E5B6>
  F824  ok? >>F863
  F826  no, bad name?
  F828  no, real error >>F842

        *** RENAME VOLUME ***

  F82A  yes, copy new name <F94B>
  F82D  error? >>F842
  F82F  get first length (D700)
  F833  get next (D700)
  F836  bad path if more than one name for vol >>F8B7
  F83B  files open on volume? (D911)
  F83E  no, continue >>F844
  F840  yes, file open error
  F842  ---
  F843  RETURN

  F844  make type/len for a VOL DIR HDR
  F84B  write new name to VOL HDR <F93C>
  F84E  error? >>F8B9
  F855  copy new name to device's VCB (D700)
  F861  exit, no errors
  F862  RETURN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F862
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         *** RENAME FILE ***

 F863  get path index <F959>
 F866  copy old name with prefix to my buffer (D700)
 F872  copy new name to buffer <F94B>
 F875  error? >>F8B9
 F877  get path index <F959>
 F87D  compare all levels of names up to and (DC00)
 F880  including the last. Find first which
 F881  differ.
 F885  save indicies into names which point to (FEB9)
 F888  final name. (FEBA)
 F88B  ---
 F895  exit if they match completely
 F896  RETURN

 F897  index to differing new name (FEB9)
 F89A  point past it (D700)
 F8A2  must be the last! (D700)
 F8A5  it isn't >>F8B7
 F8A7  it is, (FEBA)
 F8AA  do the same with the old name (DC00)
 F8B5  difference is only in last index? >>F8BB
 F8B7  no, bad path error
 F8B9  ---
 F8BA  RETURN

 F8BB  names good. follow path to new file <E5B6>
 F8BE  better get an error >>F8C4
 F8C0  if found, duplicate name in directory
 F8C3  RETURN

 F8C4  if error, better be file not found
 F8C6  or else its really an error... >>F8B9
 F8C8  copy old pathname again <E08A>
 F8CB  get its file entry <E5A3>
 F8CE  error? >>F8B9
 F8D0  search FCB's <EFB3>
 F8D5  exit if the file is open for write >>F8B9
 F8DA  does ACCESS permit rename?
 F8DC  yes >>F8E2
 F8DE  no, access error
 F8E0  ---
 F8E1  RETURN

 F8E2  get type/len from entry (FE5F)
 F8E7  DIR file?
 F8E9  yes, ok >>F8F3
 F8EB  seedling, sapling or tree?
 F8ED  yes, ok >>F8F3
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F8EF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

 F8EF  else, compatibility error
 F8F3  copy new path again <F94B>
 F8F6  error? >>F8B9
 F8F8  get length of last name (FEB9)
 F903  copy it and name to file entry buffer (D700)
 F913  combine new len with type (D700)
 F919  DIR file?
 F91B  no, go update entry and exit >>F939
 F91D  yes, (FE70)
 F927  read key block of this subdirectory <EBEE>
 F92A  error? >>F8B9
 F92F  copy new name to DIR HDR (D700)
 F934  and update directory's key block <F93C>
 F937  error? >>F8B9
 F939  go update directory entry and exit >>E4C6

F93C ********* COPY PATH TO BUFF & WRITE *****************************

 F93C  copy type/len and path to my buffer
 F948  go write the block >>EBEA

F94B ********* POINT TO NEW NAME ***************************************
         COPY TO BUFFER

 F94B  $48/$49 --> second pathname
 F956  go copy it  >>E095

F959 ********* LOAD PATH INDEX *****************************************

 F959  load pathname index
 F960  (including prefix if any) (BF9A)
 F963  ---
 F965  RETURN

F966 ****************************************************************
         ****** MLI DESTROY CALL ******
         ******************************

 F966  get file entry <E5A3>
 F969  error? >>F9B5
 F96B  find FCB if any <EFB3>
 F96E  FCB open? (FE97)
 F971  no >>F977
 F973  yes, file open error
 F976  RETURN

 F977  no free blocks needed
 F97F  go compute VCB free block count <E973>
 F982  ok? >>F989
 F984  error, disk full?
 F987  no, real error >>F9B5
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: F989
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F989  DESTROY enabled in ACCESS? (FE7D)
  F98E  yes >>F995
  F990  no, access error
  F995  check status of device (BF30)
  F99B  error? >>F9B5
  F99D  point to key block (FE70)
  F9AC  DIR file?
  F9B0  no >>F9B6
  F9B2  yes, handle differently >>FA0E

  F9B5  RETURN

          *** DESTROY NON-DIRECTORY FILE ***

  F9B6  set new storage type (FEC1)
  F9BD  zero EOF mark (FEC1)
  F9C3  byte offset = $200
  F9C8  free all blocks in file <FA78>
  F9CB  error? >>F9B5
  F9CD  free key block of seedling (FEC0)
  F9D6  error? >>F9B5
  F9D8  mark DIR entry free
  F9DD  decrement DIR file count (FE53)
  F9E8  checkpoint volume bit map <EB93>
  F9EB  error? >>F9B5
  F9ED  update free block count in VCB <F9F3>
  F9F0  and go update the directory >>E4B6

          *** SUBROUTINE TO UPDATE FREE BLOCK ***
          *** COUNT IN VCB                    ***

  F9F3  add blocks freed to total free blocks (FE91)
  F9F6  in VCB. (FEC2)
  FA08  start next search for free blocks at
  FA0A  start of bitmap. (D91C)
  FA0D  exit

          *** DESTROY DIRECTORY FILE ***

  FA0E  DIR file?
  FA10  no, error >>FA61
  FA12  read volume bitmap block <EB64>
  FA15  error? >>FA60
  FA17  BLKNUM = key block pointer (FE70)
  FA21  read it <EBEE>
  FA24  errors? >>FA60
  FA26  if DIR has any files... (DC25)
  FA30  access error
  FA35  write back block marking entry free (DC64)
  FA3B  error? >>FA60
  FA3D  if "next_pointer" is zero.... (DC02)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FA47
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FA47  go back and pretend it's a seedling >>F9CD
  FA49  else, (DC03)
  FA4C  free next block  <EA34>
  FA4F  error? >>FA60
  FA51  BLKNUM = next block (DC02)
  FA5B  read it <EBEE>
  FA5E  if ok, continue in loop >>FA3D
  FA60  else, error exit

  FA61  incompatible file format error

FA66 ********* SET WRITE OCCURRED FLAG *********************************

  FA66  save some registers
  FA69  indicate write occured (FE92)
  FA74  restore registers and exit
  FA77  RETURN

FA78 ********** TRUNCATE FILE AT EOF **********************************

  FA78  check storage type*16 (FEC1)
  FA7B  seedling?
  FA7D  yes >>FA8A
  FA7F  no, sapling?
  FA81  yes >>FA8D
  FA83  no, tree?
  FA85  yes >>FA90
  FA87  no, die horribly <BF0C>
  FA8A  go to seedling truncate >>FB5C

  FA8D  go to sapling truncate >>FB23

  FA90  truncate tree,
  FA92  at most 128 blocks in master index (FEC8)
  FA95  read the master index <FB87>
  FA98  error? >>FAF5
  FA9A  at EOF yet? (FEC8)
  FAA0  yes >>FAF6

          *** FREE WHOLE INDEX BLOCKS AFTER EOF ***
          (free 8 subindex blocks each time the
          master index block is read since we must
          qhare its buffer)

  FAA2  copy up to 8 non-zero index bnock
  FAA4  numbers to (DC00)
  FAA7  a handy table (FECA)
  FAB8  ---
  FAC1  if there weren't 8 left to do, zero (FECA)
  FAC4  remainder of the table (FED2)
  FACA  ---
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FACB
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FACB  update master index counter (FEC8)
  FAD0  for all 8 entries: (FEC9)
  FAD3  set BLKNUM (FECA)
  FADB  (exit when a 0 entry is found) >>FA95
  FAE2  read the sub-index block <EBEE>
  FAE5  error? >>FAF5
  FAE7  free all its blocks <FBB6>
  FAEA  error? >>FAF5
  FAF0  and loop to do all 8 >>FAD0
  FAF2  then go back and reread master index >>FA95
  FAF4  normal exit
  FAF5  RETURN

  FAF6  now go free all the sub-index blocks (FEC4)
  FAFA  which follow EOF <FBB8>
  FAFD  error? >>FAF5
  FAFF  write back master index <EBEA>
  FB02  error? >>FAF5
  FB04  EOF in first subindex? (FEC4)
  FB07  if so, demote to sapling fkle >>FB1E
  FB09  else, BLKNUM = subindex block which (DC00)
  FB0C  contains the EOF mark
  FB11  (exit if none there) >>FAF4
  FB18  else, read subindex block <EBEE>
  FB1B  and continue below >>FB28
  FB1D  unless there is an error

  FB1E  demote tree to sapling <FB94>
  FB21  error? >>FAF5

          *** TRUNCATE SAPLING FILE ***

  FB23  read key block <FB87>
  FB26  error?  >>FAF5
  FB28  get LSB of block number (FEC5)
  FB2C  if zero, no blocks to free >>FB38
  FB2E  else, free rest of blocks in index <FBB8>
  FB31  following the EOF. check for error >>FAF5
  FB33  write index block back <EBEA>
  FB36  error? >>FAF5
  FB38  get LSB of block number (FEC5)
  FB3B  might be block 0? >>FB52
  FB3D  no, get BLKNUM of data block (DC00)
  FB40  from index block
  FB45  (no block allocated?) >>FAF4
  FB4C  read data block <EBEE>
  FB4F  and continue below >>FB61
  FB51  unless error occured
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FB51
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FB52  back to block 0? (FEC4)
  FB55  no >>FB3D
  FB57  yes, demote to seedling <FB94>
  FB5A  error? >>FB86

          *** TRUNCATE SEEDLING FILE ***

  FB5C  read key block <FB87>
  FB5F  error? >>FB86
  FB61  first page? (FEC7)
  FB64  yes >>FB6C
  FB67  no, better be second >>FB85
  FB69  get byte offset (FEC6)
  FB6C  ---
  FB6E  zero beyond EOF mark (DD00)
  FB7C  in both pages if necessary (DC00)
  FB82  then write block back and exit >>EBEA

  FB85  exit normally
  FB86  RETURN

FB87 ********** READ KEY BLOCK ***************************************

  FB87  BLKNUM = key block number (FEBF)
  FB91  exit by reading the block >>EBEE

FB94 ********** DEMOTE FILE TO SMALLER FILE TYPE**********************

  FB94  free block (FEC0)
  FB9D  error? >>FBB5
  FB9F  get block from old index (DC00)
  FBAC  reduce storage type by one (FEC1)
  FBB4  and exit
  FBB5  RETURN

FBB6 ********** FREE ALL BLOCKS IN AN INDEX BLK **********************

  FBB6  ---
  FBB8  save BLKNUM
  FBBE  for each index entry after mark, (FE9D)
  FBC9  if it is non-zero....
  FBD0  free the block <EA34>
  FBD3  error? >>FBE4
  FBD5  zero the index entry now (FE9D)
  FBE0  ---
  FBE1  loop through all entries >>FBBE
  FBE4  ---
  FBE6  restore old BLKNUM
  FBEC  and exit
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FBEC
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


FBED ********** ALLOCATE I/O BUFFER **********************************

  FBED  ---
  FBEF  get I/O buffer page number
  FBF2  can't be below $800
  FBF4  else, error >>FC38
  FBF6  can't be above $BC00
  FBF8  else, error >>FC38
  FBFD  $4A/$4B --> I/O buffer
  FC01  must be page aligned! >>FC38
  FC07  ---
  FC08  check each page of I/O buffer for <FC73>
  FC0B  prior allocation in system bit map (BF58)
  FC18  ---
  FC19  if ok, mark each page as allocated <FC73>
  FC1C  in system memory bit map (BF58)
  FC29  assign buffer number (REFNUM*2) in FCB (D800)
  FC31  and save buffer location in buffer list
  FC36  exit
  FC37  RETURN

  FC38  bad I/O buffer error
  FC3B  RETURN

FC3C ********** LOCATE I/O BUFFER **********************************

  FC3C  ---
  FC3D  AREG contains buffer number *2 (BF6E)
  FC40  move buffer pointer to NXTBUF variable (FEDD)
  FC49  exit

FC4A ********** FREE I/O BUFFER ************************************

  FC4A  is buffer already free? <FC3C>
  FC4F  yes, exit >>FC71
  FC53  zero its address in system global page (BF6F)
  FC60  ---
  FC61  free each page in buffer <FC73>
  FC64  by marking system bit map
  FC71  exit
  FC72  RETURN

FC73 ********** LOCATE BIT MAP POSITION ****************************
          (GIVEN PAGE NUMBER)

  FC73  XREG contains page number
  FC74  compute page number times 8
  FC77  use as offset for bitmask (FE00)
  FC7E  page number / 8 = byte offset
  FC7F  into bitmap
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FC81
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FC81  exit

FC82 ********** CHECK BUFFER VALIDITY ******************************
                  START > $200    END < $BF00

  FC82  get buffer address (MSB)
  FC86  must be >$200 else error >>FC38
  FC88  get length (FEDB)
  FC8E  compute last page no. of buffer
  FC93  ---
  FC9A  may not extend into $BF00
  FC9C  else, error >>FC38

          *** CHECK IF BLOCK OF MEMORY IS FREE ***

  FC9F  ---
  FCA0  see if this page is allocated <FC73>
  FCA6  if so, error >>FC38
  FCA8  else, check other paee also
  FCAC  then exit if both have been checked
  FCAD  RETURN

FCAE ************************************************************
          ****** MLI GET_BUFF CALL ******
          ********************************

  FCAE  get next available buffer
  FCB3  put its address in caller's parmlist
  FCBB  and exit
  FCBC  RETURN

FCBD ************************************************************
          ****** MLI SET_BUFF CALL ******
          ********************************

  FCBD  mark his buffer allocated
  FCC2  error? >>FCE4
  FCC4  get old buffer address (FEDE)
  FCCE  free old buffer's pages in map <FC59>
  FCD5  copy old buffer contents
  FCD7  to new buffer
  FCE3  then exit
  FCE4  RETURN

FCE5 ********* GO TO QUIT CODE HANDLER *****************************

  FCE5  enable 2nd 4K bank of language card (C083)
  FCE8  (it lives at $D100-$D3FF) (C083)
  FCEB  Save zeropage $00 through $03 on stack
  FCF7  Set ($00) -> $D100
  FCF9  Set ($02) -> $1000
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FD05
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD05   Set Y = Ø
  FD06  3 pages of code to copy
  FD08  ---
  FD09  copy quit code handler to $1ØØØ
  FD17   Restore zero page to original state
  FD23  enable HIGH RAM BANK1 (CØ8B)
  FD26  (MLI) (CØ8B)
  FD2B  point RESET vector at $1ØØØ (Ø3F2)
  FD33  set power-up byte properly
  FD38  go to quit code handler at $1ØØØ >>1ØØØ

FD3B ********** NEW ROUTINE ***************************************
           THE ADDRESS OF THIS ROUTINE IS AT $3EA.
           WE COULD NOT DETERMINE ITS PURPOSE.

  FD3B  ---
  FD3C  get current P-reg in accumulator
  FD3D  save current P-reg
  FD3E  clear overflow flag
  FD3F  interrupts disabled?
  FD41  no >>FD46
  FD43  yes, set overflow flag (FD64)
  FD46  disable interrupts
  FD47  enable RAM, BANK2 (CØ83)
  FD4D  set carry, indicating error
  FD4E  pass a 5 to page 3 subroutine
  FD5Ø  call a page 3 subroutine <Ø3D6>
  FD53  store error number (BFØF)
  FD56  enable RAM, BANK1 (CØ8B)
  FD5C  restore original P-reg
  FD5E  if error number is zero, (BFØF)
  FD61  then indicate no error; >>FD64
  FD63  otherwise indicate error
  FD64  RETURN

FD65 *************************************************************
          *       DATA AREA                *
          **********************************

FD65 ********** MLI COMMAND TABLE ************************************
          IN HASH CODE ORDER: IF COMMAND IS...
          ABCD EFGH (IN BINARY BITS)
          INDEX IS COMPUTED AS:
             ØØØD EFGH
            +ØØØØ ABCD

  FD65  GET BUF
  FD66  UNUSED
  FD67  UNUSED
  FD68  UNUSED
  FD69  ALLOC INTERRUPT
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FD6A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD6A  DEALLOC INTERRUPT
  FD6B  UNUSED
  FD6C  UNUSED
  FD6D  READ BLOCK
  FD6E  WRITE BLOCK
  FD6F  GET TIME
  FD7Ø  EXIT
  FD71  CREATE
  FD72  DESTROY
  FD73  RENAME
  FD74  SET FILE INFO
  FD75  GET FILE INFO
  FD76  ON LINE
  FD77  SET PREFIX
  FD78  GET PREFIX
  FD79  OPEN
  FD7A  NEWLINE
  FD7B  READ
  FD7C  WRITE
  FD7D  CLOSE
  FD7E  FLUSH
  FD7F  SET MARK
  FD8Ø  GET MARK
  FD81  UNUSED
  FD82  SET EOF
  FD83  GET EOF
  FD84  SET BUF

FD85 ********** PARAMETER COUNT TABLE *********************************

  FD85  GET BUF
  FD86  UNUSED
  FD87  UNUSED
  FD88  UNUSED
  FD89  ALLOC INTERRUPT
  FD8A  DEALLOC INTERRUPT
  FD8B  UNUSED
  FD8C  UNUSED
  FD8D  READ BLOCK
  FD8E  WRITE BLOCK
  FD8F  GET TIME
  FD9Ø  EXIT
  FD91  CREATE
  FD92  DESTROY
  FD93  RENAME
  FD94  SET FILE INFO
  FD95  GET FILE INFO
  FD96  ON LINE
  FD97  SET PREFIX
  FD98  GET PREFIX
  FD99  OPEN
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FD9A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD9A  NEWLINE
  FD9B  READ
  FD9C  WRITE
  FD9D  CLOSE
  FD9E  FLUSH
  FD9F  SET MARK
  FDA0  GET MARK
  FDA1  UNUSED
  FDA2  SET EOF
  FDA3  GET EOF
  FDA4  SET BUF

FDA5 ********** MLI COMMAND ADDRESS TABLE ****************************

  FDA5  CREATE
  FDA7  DESTROY
  FDA9  RENAME
  FDAB  SET FILE INFO
  FDAD  GET FILE INFO
  FDAF  ON LINE
  FDB1  SET PREFIX
  FDB3  GET PREFIX
  FDB5  OPEN
  FDB7  NEWLINE
  FDB9  READ
  FDBB  WRITE
  FDBD  CLOSE
  FDBF  FLUSH
  FDC1  SET MARK
  FDC3  GET MARK
  FDC5  SET EOF
  FDC7  GET EOF
  FDC9  SET BUF
  FDCB  GET BUF

FDCD ********** MLI COMMAND INFO BYTE *********************************

          PATHNAME FLAG
          | REFERENCE NUMBER FLAG
          | | DATETIME STAMP FLAG
          | | |     COMMAND NUMBER
          | | |     |
  FDCD    1 0 1  - 00
  FDCE    1 0 1  - 01
  FDCF    1 0 1  - 02
  FDD0    1 0 1  - 03
  FDD1    1 0 0  - 04
  FDD2    0 0 0  - 05
  FDD3    0 0 0  - 06
  FDD4    0 0 0  - 07
  FDD5    1 0 0  - 08
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FDD6
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FDD6   0 1 0  - 09
  FDD7   0 1 0  - 0A
  FDD8   0 1 0  - 0B
  FDD9   0 0 1  - 0C
  FDDA   0 0 1  - 0D
  FDDB   0 1 0  - 0E
  FDDC   0 1 0  - 0F
  FDDD   0 1 0  - 10
  FDDE   0 1 0  - 11
  FDDF   0 1 0  - 12
  FDE0   0 1 0  - 13

FDE1 ********** CONSTANTS - DATA AREA ********************************

  FDE1  Blocks Used
  FDE3  End of File
  FDE6  Special ID (Must be 5 bits on)
  FDE7  'HUSTON!'       Author's name
  FDEE  Previous Block of Vol Dir Key Block
          ---
          THE FOLLOWING IS COPIED TO SUBDIR HDR+$20
  FDF0  Version of ProDOS
  FDF1  Minimum Version
  FDF2  Access Byte  (D|Rn|B|000|W|R)
  FDF3  Entry Length
  FDF4  Entries per Block
  FDF5  File Count
  FDF7  Parent LSB (copied to SUBDIR HDR +$20)
          ---
  FDF8  File Type  (Directory)
  FDF9  Block Number
  FDFB  Number of Blocks
  FDFD  End of File

FE00 ********** BITMASK TABLE ***************************************

  FE00  10000000
  FE01  01000000
  FE02  00100000
  FE03  00010000
  FE04  00001000
  FE05  00000100
  FE06  00000010
  FE07  00000001

FE08 ********** OFFSETS TO DATA AT $F300 *****************************
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FE08
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FE08  Key Block

  FE0A  # Blocks Used

  FE0C  End of File

FE0F ********** SET/GET FILE_INFO OFFSETS ****************************

  FE0F  Access
  FE10  File Type
  FE11  Aux Type
  FE13  Storage Type
  FE14  Blocks Used (MSB on means GET only no SET)

  FE16  Datetime (Last Mod)

  FE1A  Datetime (Creation)

FE1E ********** FATAL ERROR MESSAGE **********************************

  FE1E    INSERT SYSTEM DISK AND RESTART

  FE46  ---

FE46 ********** VARIABLES - DATA AREA ********************************

  FE46  Parent Pointer Block
  FE48  Parent Entry Number
  FE49  Parent Entry Length
  FE4A  Datetime (Creation)
  FE4E  Version
  FE4F  Min Version
  FE50  Access Byte
  FE51  Entry Length
  FE52  Entries per Block
  FE53  File Count
  FE55  Bit Map Pointer
  FE57  Total Blocks
          THE FOLLOWING 6 BYTES UNIQUELY IDENTIFY
          A FILE:
  FE59  Device Number
  FE5A  Current Directory Block Number (HDR)
  FE5C  Block Number of File Entry in Directory
  FE5E  File Entry Number in Directory
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FE5F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FE5F ********** FILE ENTRY BUFFER **************************************

  FE5F  Type/Length  (TTTTLLLL)
  FE60  File Name (Max 15) >>000F
  FE6F  File Type
  FE70  Key Pointer
  FE72  Blocks Used
  FE74  End of File
  FE77  Datetime (Creation)
  FE7B  Version
  FE7C  Min Version
  FE7D  Access Attribute
  FE7E  Aux Type (Load Address/Record Length)
  FE80  Datetime (Last Mod)

  FE84  Header Pointer

FE86 ********** Variable Work Area **************************************

  FE86  3 Byte Scratch

  FE89  ---

  FE8A  End of File

  FE8D  Previous Mark

  FE90  Compare Vol Name Scratch
  FE91  Offset into VCB Table ($D900)
  FE92  Offset into FCB Table ($D800)
  FE93  Free FCB found Flag

  FE94  Number of Free Blocks needed

  FE96  Storage Type
          Number of Entries Examined or..
  FE97  FCB already open flag
  FE98  File Count

  FE9A  Entries/Block Loop Count/Free FCB's refnum
          Free Entry Found Flag (if > 0) or..
          # of 1st bitmap block with free bit on or..
  FE9B  bit for free
  FE9C  # Blocks in Bitmap left to search
  FE9D  Y Register temp
  FE9E  Pathname Length
  FE9F  Devnum for Prefix Directory Header
  FEA0  Block of Prefix Directory Header
  FEA2  Bitmap Byte Offset in Page
  FEA3  Bitmap Page Offset
  FEA4  Bitmap Buffer Page (0 or 1)
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FEA5
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  FEA5  Bitmap Flag (if $80, needs writing)
  FEA6  Bitmap DEVNUM
  FEA7  Bitmap Block Number
  FEA9  Bitmap Block offset for Multiblock Bitmaps

          New Mark to be Positioned to for Set Mark
          or New Moving Mark (for READ)
  FEAA  or New EOF for SET_EOF

  FEAD  Request Count (Read/Write etc.)
  FEAF  Multi-Block I/O count
  FEB0  Newline character
  FEB1  Newline mask
  FEB2  I/O Transfer occurred flag
  FEB3  MLI Command * 2
  FEB4  ORed into Access Flags ($20 - Backup)
  FEB5  Duplicate Volume Flag (if $FF)
  FEB6  Duplicate Volume's VCB index
  FEB7  MLI function code (low 5 bits)
          Characters in current Pathname indx lvl or
  FEB8  ONLINE: volname len - loop index
  FEB9  new pathname: index to last name
          old pathname: index to last name or..
  FEBA  ONLINE: index to data buffer
  FEBB  Old PFIXPTR value
  FEBC  Pathname fully qualified flag (if $FF)
          Pathname: temp save area for index or..
  FEBD  ONLINE: DEVCNT
  FEBE  close-all error code
  FEBF  Set EOF: new Key Block pointer
  FEC1  New storage type (SET_EOF)
  FEC2  Freed Blocks count
  FEC4  EOF Block number (MSB then LSB)
  FEC6  EOF byte offset into Block
  FEC8  EOF - Master index counter
  FEC9  Save area for index into table below

FECA ********** DEVICE TABLE BUILT BY ONLINE ************************
          (also used by SET_EOF to keep track of
          8 blocks to be freed at a time)

  FECA  device table part one
  FED2  device table part two

  FEDA  length of path, etc.
  FEDD  next buffer address
  FEDF  16 byte stack save area
  FEEF  6 byte zero page save area
  FEF5  Jump Vector, used for indirect jumps
```

```
ProDOS MLI -- V1.1.1 -- 18 SEP 84                NEXT OBJECT ADDR: FEF5
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

FEF7 ********** $FEF7-$FEFF NOT USED *******************************
  FEF7  not used
```

ProDOS SYSTEM GLOBAL PAGE--MLI Global Page

Portions of this page of memory are rigidly defined by the MLI and are unlikely to move in later versions of ProDOS. However, some portions are less stable and could change in future releases.

ProDOS System Global Page NEXT OBJECT ADDRESS: BF00

ADDR	LABEL	CONTENTS
		Jump Vectors
BF00-BF02	ENTRY	JMP to MLI.
BF03-BF05	JSPARE	JMP to system death code (via $BFF6).
BF06-BF08	DATETIME	JMP to Date/Time routine (RTS if no clock).
BF09-BF0B	SYSERR	JMP to system error handler.
BF0C-BF0E	SYSDEATH	JMP to system death handler.
BF0F	SERR	System error number.
		Device Information
BF10-BF11	DEVADR01	Slot 0 reserved
BF12-BF13	DEVADR11	Slot 1, drive 1 device driver address.
BF14-BF15	DEVADR21	Slot 2, drive 1 device driver address.
BF16-BF17	DEVADR31	Slot 3, drive 1 device driver address.
BF18-BF19	DEVADR41	Slot 4, drive 1 device driver address.
BF1A-BF1B	DEVADR51	Slot 5, drive 1 device driver address.
BF1C-BF1D	DEVADR61	Slot 6, drive 1 device driver address.
BF1E-BF1F	DEVADR71	Slot 7, drive 1 device driver address.
BF20-BF21	DEVADR02	Slot 0 reserved.
BF22-BF23	DEVADR12	Slot 1, drive 2 device driver address.
BF24-BF25	DEVADR22	Slot 2, drive 2 device driver address.
BF26-BF27	DEVADR32	/RAM device driver address (need extra 64K).
BF28-BF29	DEVADR42	Slot 4, drive 2 device driver address.
BF2A-BF2B	DEVADR52	Slot 5, drive 2 device driver address.
BF2C-BF2D	DEVADR62	Slot 6, drive 2 device driver address.
BF2E-BF2F	DEVADR72	Slot 7, drive 2 device driver address.
BF30	DEVNUM	Slot and drive (DSSS0000) of last device.
BF31	DEVCNT	Count (minus 1) of active devices.
BF32-BF3F	DEVLST	List of active devices (slot, drive and identification--DSSSIIII).
BF40-BF4F		Copyright notice.
BF50-BF55	IRQXITX	Switch in language card and call IRQ handler at $FFD8.
BF56-BF57	TEMP	Temporary storage for IRQ code.
BF58-BF6F	BITMAP	Bitmap of low 48K of memory.
BF70-BF71	BUFFER1	Open file 1 buffer address.
BF72-BF73	BUFFER2	Open file 2 buffer address.
BF74-BF75	BUFFER3	Open file 3 buffer address.
BF76-BF77	BUFFER4	Open file 4 buffer address.
BF78-BF79	BUFFER5	Open file 5 buffer address.
BF7A-BF7B	BUFFER6	Open file 6 buffer address.
BF7C-BF7D	BUFFER7	Open file 7 buffer address.
BF7E-BF7F	BUFFER8	Open file 8 buffer address.

ProDOS System Global Page NEXT OBJECT ADDRESS: BF80

ADDR	LABEL	CONTENTS
		Interrupt Information
BF80-BF81	INTRUPT1	Interrupt handler address (highest priority).
BF82-BF83	INTRUPT2	Interrupt handler address.
BF84-BF85	INTRUPT3	Interrupt handler address.
BF86-BF87	INTRUPT4	Interrupt handler address (lowest priority).
BF88	INTAREG	A-register savearea.
BF89	INTXREG	X-register savearea.
BF8A	INTYREG	Y-register savearea.
BF8B	INTSREG	S-register savearea.
BF8C	INTPREG	P-register savearea.
BF8D	INTBANKID	Bank ID byte (ROM, RAM1, or RAM2).
BF8E-BF8F	INTADDR	Interrupt return address.
		General System Info
BF90-BF91	DATE	YYYYYYYM MMMDDDDD.
BF92-BF93	TIME	...HHHHH ..MMMMMM.
BF94	LEVEL	Current file level.
BF95	BUBIT	Backup bit.
BF96-BF97	SPARE1	Currently unused.
BF98	MACHID	Machine ID byte. 00.. 0... II 01.. 0... II+ 10.. 0... IIe 11.. 0... III emulation 00.. 1... Future expansion 01.. 1... Future expansion 10.. 1... IIc 11.. 1... Future expansion ..00 .... Unused ..01 .... 48K ..10 .... 64K ..11 .... 128K .... .X.. Reserved .... ..0. No 80-column card .... ..1. 80-column card present ....0 No compatible clock ....1 Compatible clock present
BF99	SLTBYT	Slot ROM map (bit on indicates ROM present).
BF9A	PFIXPTR	Prefix flag (0 indicates no active prefix).
BF9B	MLIACTV	MLI active flag (1... .... indicates active).
BF9C-BF9D	CMDADR	Last MLI call return address.
BF9E	SAVEX	X-register savearea for MLI calls.
BF9F	SAVEY	Y-register savearea for MLI calls.

ProDOS System Global Page NEXT OBJECT ADDRESS: BFA0

ADDR	LABEL	CONTENTS
		Language Card Bank Switching Routines
BFA0-BFCF		Language card entry and exit routines.
BFA0	EXIT	
BFAA	EXIT1	
BFB5	EXIT2	
BFB7	MLIENT1	
		Interrupt Routines
BFD0-BFF3		Interrupt entry and exit routines.
BFD0	IRQXIT	
BFDF	IRQXIT1	
BFE2	IRQXIT2	
BFE7	ROMXIT	
BFEB	IRQENT	
		Data
BFF4	BNKBYT1	Storage for byte at $E000.
BFF5	BNKBYT2	Storage for byte at $D000.
BFF6-BFFB		Switch on language card and call system death handler ($D1E4).
		Version Information
BFFC	IBAKVER	Minimum version of Kernel needed for this interpreter.
BFFD	IVERSION	Version number of this interpreter.
BFFE	KBAKVER	Minimum version of Kernel compatible with this Kernel.
BFFF	KVERSION	Version number of this Kernel.

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 1000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

1000    MODULE STARTING ADDRESS

            ************************************
            *                                  *
            * QUIT Code                        *
            *     Stored in BANK2 of High RAM  *
            *     at $D100 and moved to $1000  *
            *     by an ML1 routine at $FC35,  *
            *     which JMPs to $1000.         *
            *                                  *
            * VERSION 1.1.1 -- 18 SEP 84       *
            * (The QUIT code is still the same *
            *  as it was in Version 1.0.1)     *
            *                                  *
            ************************************

1000 ********** ZERO PAGE EQUATES **********************************

0024    Cursor Horizontal
0025    Cursor Vertical

1000 ********** EXTERNAL EQUATES ************************************

0280    Prefix Buffer
1800    Buffer
2000    Buffer
BF00    ML1 Entry
BF58    Bitmap

1000 ********** SOFT SWITCHES ***************************************

C000    Keyboard
C000    Disable 80 column store
C00C    Disable 80 column card
C00F    Select alternate character set
C010    Keyboard Strobe
C082    ROM select

1000 ********** MONITOR EQUATES *************************************

FC58    Home
FC9C    Clear to end of line
FD0C    Read a key
FD8E    Output a Carriage Return
FDED    Output a Character
FE89    Set Keyboard
FE93    Set Video
FF3A    Sound Bell
```

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 1000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

1000 ********** INITIALIZATION **************************************

  1000  Select ROM (C082)
  1003  Set Video <FE93>
  1006  Set Keyboard <FE89>
  1009  Disable 80 column card (C00C)
  100C  Select Alternate character set  (C00F)
  100F  Disable 80 column store (C000)

1012 ********** INITIALIZE MEMORY BITMAP ****************************

  1012  Mark pages $0, $1, $4 through $7
  1014  and $BF as in use

1027 ********** DISPLAY CURRENT PREFIX ******************************

  1027  Clear Screen and Home cursor <FC58>
  102A  Go down 1 line <FD8E>
  102D  Get Pointer to Prompt1 (Prefix)
  102F  and store it in Print Routine (11E9)
  1037  Call Print Routine <11E6>
  103A  Position to line 3
  1041  Call MLI (GET_PREFIX) <BF00>
  1044  Data: GET_PREFIX command number
  1045  Data: Pointer to Parameter list
  1047  Terminate Prefix with 0 (0280)
  104A  for Print routine
  104F  Get Pointer to Prefix
  1051  and store it in Print Routine (11E9)
  1059  And Print it <11E6>

105C ********** GET PREFIX NAME **************************************

  105C  Initialize counter
  1063  Read a key <FD0C>
  1066  Is it CARRIAGE RETURN?
  1068  Yes, then accept Prefix >>10B8
  106A  No, then save character
  106B  Clear to end of line <FC9C>
  106E  Retrieve character
  106F  Is it ESCAPE?
  1071  Yes, then start all over again >>1027
  1073  Is it CANCEL?
  1075  Yes, then start all over again >>1027
  1077  Is it TAB?
  1079  Yes, then sound Bell, get another character >>108E
  107B  Is it BACKSPACE?
  107D  No, then keep checking >>108C
  107F  Yes, then is there room to move back?
  1081  No, then don't try  >>1086
```

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 1083
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  1083  Decrement cursor horizontal position
  1085  Decrement counter
  1086  Clear to end of line <FC9C>
  1089  Try again >>1063

  108C  Continue if greater than or equal to BACKSPACE >>1094
  108E  Else, sound Bell <FF3A>
  1091  Try again >>1063

  1094  Is it less than or equal to "Z"?
  1096  Yes, keep checking >>109A
  1098  Turn off lowercase
  109A  Is it less than "."?
  109C  Yes, Invalid - try again >>108E
  109E  Is it greater than "Z"?
  10A0  Yes, Invalid - try again >>108E
  10A2  Is it less than or equal to "9"?
  10A4  Yes, keep checking >>10AA
  10A6  Is it less than "A"?
  10A8  Yes, Invalid - try again >>108E
  10AA  Else, valid character - increment counter
  10AB  Found 39 characters?
  10AD  Yes, then start all over >>1075
  10AF  Put valid character in buffer (0280)
  10B2  and Print it <FDED>
  10B5  Go back for more >>1063

  10B8  Check counter
  10BA  If 0 then go on >>10CE
  10BC  Else, save length (0280)
  10BF  Call MLI (SET_PREFIX) <BF00>
  10C2  Data: SET_PREFIX command number
  10C3  Data: Pointer to Parameter list
  10C5  Carry on if no error >>10CE
  10C7  Sound Bell <FF3A>
  10CA  Force branch to
  10CC  always be taken >>1075

10CE ********** GET APPLICATION NAME **********************************

  10CE  Clear Screen and Home cursor <FC58>
  10D1  Go down 1 line <FD8E>
  10D4  Get Pointer to Prompt2 (Application)
  10D6  and store it in Print Routine (11E9)
  10DE  Print it <11E6>
  10E1  Position to line 3
  10E8  Initialize counter
  10EA  Output a RUB
  10F1  Poll Keyboard latch (C000)
  10F4  Loop until keypress found >>10F1
  10F6  Clear latch (C010)
```

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 10F9
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  10F9  Is it ESCAPE?
  10FB  No, keep checking >>1103
  10FD  Yes, get Cursor horizontal position
  10FF  If not 0 try again >>10CE
  1101  If 0 start all over again >>10CC
  1103  Is it CANCEL?
  1105  Yes, try again >>10CE
  1107  Is it TAB?
  1109  Yes, sound Bell - try again >>1114
  110B  Is it BACKSPACE?
  110D  No, keep checking >>1112
  110F  Yes, then handle it >>11D0

  1112  Continue if greater than or equal to BACKSPACE >>111A
  1114  Sound Bell <FF3A>
  1117  Go back and try again >>10EA

  111A  Is it CARRIAGE RETURN?
  111C  Yes, then go load Application >>1147
  111E  Is it less than or equal to "Z"?
  1120  Yes, keep checking >>1124
  1122  Turn off lower case
  1124  Is it less than "."?
  1126  Yes, Invalid - try again >>1114
  1128  Is it greater than "Z"?
  112A  Yes, Invalid - try again >>1114
  112C  Is it less than or equal to "9"?
  112E  Yes, keep checking >>1134
  1130  Is it less than "A"?
  1132  Yes, Invalid - try again >>1114
  1134  Else, valid character - save it
  1135  Clear to end of line <FC9C>
  1138  Retrieve character
  1139  and Print it <FDED>
  113C  Increment counter
  113D  Found 39 characters?
  113F  Yes, start again >>1105
  1141  No, save character in buffer (0280)
  1144  and go get another >>10EA

1147 ********** LOAD AND EXECUTE APPLICATION ************************

  1147  Output a blank
  114C  Store length of Application name (0280)
  114F  Call MLI (GET_FILE_INFO) <BF00>
  1152  Data: GET_FILE_INFO command number
  1153  Data: Pointer to Parameter list
  1155  Continue if no error >>115A
  1157  Else, go to Error Handler >>11F6
```

```
ProDOS QU1T Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 1157
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

 115A  Get File Type (12D5)
 115D  Is it ProDOS System file?
 115F  Yes, continue >>1166
 1161  No, indicate Error $01
 1163  Go to Error Handler >>11F6

 1166  Set Reference number to 0
 116B  Call MLI (CLOSE) <BF00>
 116E  Data: CLOSE command number
 116F  Data: Pointer to Parameter list
 1171  Continue if no error >>1176
 1173  Else, go to Error Handler >>11F6
 1176  Get Access Byte (12D4)
 117B  Yes, >>1182
 117D  No, lndicate Error $27
 117F  Go to Error Handler >>11F6

 1182  Call ML1 (OPEN) <BF00>
 1185  Data: OPEN command number
 1186  Data: Pointer to Parameter list
 1188  Continue if no error >>118D
 118A  Else, go to Error Handler >>11F6

 118D  Get Reference Number (12E8)
 1190  and update READ and (12EC)
 1193  GET_EOF parameter lists (12F4)
 1196  Call ML1 (GET_EOF) <BF00>
 1199  Data: GET_EOF command number
 119A  Data: Pointer to Parameter list
 119C  Continue if no error >>11A1
 119E  Else, go to Error Handler >>11F6

 11A1  Is EOF mark less than $10000 (12F7)
 11A4  Yes, continue on >>11AB
 11A6  No, lndicate Error $27
 11A8  Go to Error Handler >>11F6

 11AB  Transfer EOF to Request count (12F5)
 11AE  in READ parameter list (12EF)
 11B7  Call ML1 (READ) <BF00>
 11BA  Data: READ command number
 11BB  Data: Pointer to Parameter list
 11BD  Save status of READ
 11BE  Call ML1 (CLOSE) <BF00>
 11C1  Data: Get_Prefix command number
 11C2  Data: Pointer to Parameter list
 11C4  Continue if no error >>11CA
 11C6  Else, retrieve status
 11C7  and go to Error Handler >>11F6
```

```
ProDOS QU1T Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 11C7
-------------------------------------------------------------------------
ADDR    DESCR1PTION/CONTENTS
-------------------------------------------------------------------------

 11CA  Was READ good?
 11CB  No, go to Error Handler >>11C7
 11CD  Yes, execute application >>2000

11D0 ********** BACKSPACE ROUTINE ************************************

 11D0  Get cursor position horizontal
 11D2  If 0 exit routine >>11E3
 11D4  Decrement counter
 11D5  Output a space
 11DA  Move cursor back 2 spaces
 11DE  Output a space <FDED>
 11E1  Move cursor back 1 space
 11E3  Return to get another character  >>10EA

11E6 ********** PRINT TEXT ROUTINE ***********************************

 11E6  1nitialize offset
 11E8  Get a character (11E8)
 11EB  If it is 0 then exit >>11F5
 11EF  Output it <FDED>
 11F2  Increment offset
 11F3  Get another character unless we've done 256 >>11E8
 11F5  Return to caller

11F6 ********** PRINT ERROR MESSAGE **********************************

 11F6  Save Accumulator (Error Number)
 11F8  Position to line 12
 11FF  Get Error number
 1201  1s it $01?
 1203  No, then keep checking >>1211
 1205  Get Pointer to Error1 (Not System file)
 1207  and store it in Print Routine (11E9)
 120F  Branch always taken >>1237
 1211  1s it $40?
 1213  Yes, then indicate Error3 >>122D
 1215  Is it $44?
 1217  Yes, then indicate Error3 >>122D
 1219  Is it $45?
 121B  Yes, then indicate Error3 >>122D
 121D  Is it $46?
 121F  Yes, then indicate Error3 >>122D
 1221  Else, Get Pointer to Error2 (I/O Error)
 1223  and store it in Print Routine (11E9)
 122B  Branch always taken >>1237
 122D  Get Pointer to Error3 (Path not found)
 122F  and store it in Print Routine (11E9)
 1237  Print Error message <11E6>
 123A  Position to line 0
```

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 123E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  123E  Return to Get Application code >>1ØD1

1241 ********** ASCII TEXT ****************************************

          Prompt1
  1241  'ENTER PREFIX (PRESS "RETURN" TO ACCEPT)'

          Prompt2
  1269  'ENTER PATHNAME OF NEXT APPLICATION'

          Error1
  128C  Ring Bell
  128D  'NOT A TYPE "SYS" FILE'

          Error2
  12A3  Ring Bell
  12A4  'I/O ERROR

          Error3
  12BA  Ring Bell
  12BB  'FILE/PATH NOT FOUND

12D1 ********** PARAMETER LISTS ***********************************

          GET_FILE_INFO Parmlist
  12D1  Parmcount
  12D2  Pathname
  12D4  Access
  12D5  File Type
  12D6  Aux Type
  12D8  Storage Type
  12D9  Blocks Used
  12DB  Datetime (modified)
  12DF  Datetime (creation)

          OPEN Parmlist

  12E3  Parmcount
  12E4  Pathname
  12E6  I/O Buffer
  12E8  Reference Number

          CLOSE Parmlist

  12E9  Parmcount
  12EA  Reference Number
```

```
ProDOS QUIT Code -- V1.1.1 -- 18 SEP 84          NEXT OBJECT ADDR: 12EA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

          READ Parmlist

  12EB  Parmcount
  12EC  Reference Number
  12ED  Data Buffer
  12EF  Request Count
  12F1  Transfer Count

          GET_EOF Parmlist

  12F3  Parmcount
  12F4  Reference Number
  12F5  EOF Mark

          GET/SET_PREFIX Parmlist

  12F8  Parmcount
  12F9  Pathname

12FB *********** $12FB-$12FF UNUSED *********************************

  12FB  These unused bytes are $D3FB-$D3FF in high RAM
  12FF  and $59FB-$59FF when loaded as part of "PRODOS" file.
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D000
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

D000    MODULE STARTING ADDRESS

            ************************************
            *                                  *
            *  5.25" DISK DEVICE DRIVER        *
            *                                  *
            *      RESIDES AT $D000-$D6FF      *
            *                                  *
            *                                  *
            *  VERSION 1.1.1 -- 18 SEP 84      *
            *                                  *
            ************************************

D000 ********** ZERO PAGE EQUATES ***********************************

003A    Checksum
003A    Workbyte
003E    Slot (Temporary)
0042    Command
0043    Unit Number
0044    I/O Buffer Pointer (low)
0045    I/O Buffer Pointer (high)
0046    Block Number (low)
0047    Block Number (high)

D000 ********** INTERNAL EQUATES *************************************

1000    Dummy Block Buffer (1st half)
1100    Dummy Block Buffer (2nd half)

D000 ********** EXTERNAL EQUATES *************************************

C080    Phase Zero Off
C088    Motor Off
C089    Motor On
C08A    Drive Select
C08C    Read Data Register
C08D    Write Data Register
C08E    Set Read Mode
C08F    Set Write Mode
C0EC    Read Data Register (slot 6)

D000 ********** 5.25" DISK DRIVER ENTRY ******************************

  D000  Clear decimal mode
  D001  Clear phases in case IWM device in this slot <D6BE>
  D004  Five NOP's so code below will
  D005  fit up against Table at $D196
  D009  Check validity of calling parameters <D6D0>
  D00C  If not valid exit with error >>D034
  D00E  Convert Block Number to a Track and Sector
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D010
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D010  ---
  D014  0000000T TTTTTABC
  D015            .     . >>D010
  D017          .       .
  D018        .         . >>D01C
  D01A  00TTTTTT 0000BC0A
  D01C  ---
  D020  Preserve Sector Number
  D021  Execute command <D038>
  D024  Restore Sector Number - Was prior action ok?
  D025  No, then exit >>D030
  D027  Increment Buffer Pointer
  D029  Increment Sector Number by 2 for rest of Block
  D02B  Execute command <D038>
  D02E  Decrement Buffer Pointer (to start of block)
  D030  Get error number (if any - 0 indicates no error) (D358)
  D033  Return to caller

D034 ********** I/O ERROR ROUTINE ************************************

  D034  Indicate "I/O Error"
  D036  Set Carry flag
  D037  Return to caller

D038 ********** MAIN CODE ********************************************

  D038  Set recalibration count to 1
  D03D  Preserve sector number (D357)
  D040  Get "Unitnum"   DSSS0000
  D042  Strip out Drive 0SSS0000
  D044  Preserve slot number
  D046  Check for slot change, turn off motor if so <D69B>
  D049  See if motor is on <D4DA>
  D04C  Save test results
  D04F  Initialize counter for delay routine (D370)
  D054  See if slot or drive has changed (D359)
  D057  Update "current" unit number (D359)
  D05A  Save test results
  D05B  Put drive number in Carry flag
  D05C  Turn motor on (C089)
  D062  Select appropriate drive (C08A)
  D065  Check test results - Same slot/drive?
  D066  Yes, then skip delay >>D072
  D069  Wait for new Drive
  D06B  to come up to speed <D385>
  D072  Is command a status request?
  D074  Yes, then do not move disk arm >>D07C
  D076  Get track number for current request  (D356)
  D079  And go there <D10C>
  D07C  Check test results - Was motor on?
  D07D  Yes, then skip delay >>D08E
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D07F
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D07F  Wait for Drive to
  D081  come up to speed <D385>
  D089  Is motor on yet? <D4DA>
  D08C  No, then exit with error >>D0EA
  D08E  Is command a "status" request?
  D090  Yes, then determine status >>D0FD
  D092  Is command a "read" request?
  D093  Yes, then continue on >>D098
  D095  Prepare data for write (prenibblize) <D5F0>
  D098  ---
  D09A  Initialize "retry" count at 64 (D369)
  D09D  ---
  D09F  Read an address field - Good read? <D398>
  D0A2  Yes, then continue on >>D0BE
  D0A4  Decrement "retry" count - More to try? (D369)
  D0A7  Yes, then try again >>D09D
  D0A9  No, just in case indicate "I/O Error"
  D0AB  Decrement "recalibration" count - More to try? (D36A)
  D0AE  No, then exit with error >>D0EA
  D0B0  Get "current" track (D35A)
  D0B3  Preserve it
  D0B4  Double it and
  D0B5  add 16 to it for recalibration
  D0B7  Reinitialize Retry Count
  D0BC  Branch always taken >>D0CC
  D0C1  Was the right track found? (D35A)
  D0C4  Yes, then continue on >>D0D5
  D0C6  Get "current" track (D35A)
  D0C9  Preserve it
  D0CA  Get track we found
  D0CB  Double it
  D0CC  Put new value in Device Track Table <D4D3>
  D0CF  Get track we want
  D0D0  And go there <D10C>
  D0D3  Branch always taken >>D09D
  D0D8  Was the right sector found? (D357)
  D0DB  No, then try again >>D0A4
  D0DF  Is command a "write" request?
  D0E0  Yes, then go do it >>D0F4
  D0E2  Read the data - Good read? <D3FD>
  D0E5  No, then try again >>D0A4
  D0E7  Indicate no errors
  D0E9  BNE Instruction, never taken
  D0EA  Indicate error
  D0EB  Preserve error number (D358)
  D0EE  Get Slot
  D0F0  Turn motor off (C088)
  D0F3  Return to caller
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D0F3
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

D0F4 ********** HANDLE WRITE REQUEST **********************************

  D0F4  Write data - Good write? <D500>
  D0F7  Yes, then exit >>D0E7
  D0F9  Indicate "Write-protect error"
  D0FB  Branch always taken >>D0EA

D0FD ********** GET STATUS ***************************************************

  D0FD  Get Slot number
  D100  Check "write-protect" status (C08E)
  D105  Put result in Carry flag
  D106  Select read mode (C08C)
  D109  Exit with appropriate status >>D0F7

D10C ********** LOCATE DESIRED TRACK **********************************

  D10C  Double the track number for proper phase
  D10D  Preserve destination track * 2 (D36F)
  D110  Turn all phases off <D125>
  D113  Get offset into Device Track Table <D4F1>
  D116  Get track (D359)
  D119  Update "current" track (D35A)
  D11C  Get destination track (D36F)
  D11F  Update Device Track Table (D359)
  D122  Move arm to desired track <D133>
  D125  Initialize phase number, starting with 3
  D127  ---
  D128  Clear a phase <D18A>
  D12B  Decrement phase number - More to do?
  D12C  Yes, then continue until all phases done >>D127
  D12E  Divide track number by 2 (D35A)
  D132  Return to caller

D133 ********** ARM MOVE ROUTINE ************************************

  D133  Preserve track to find (D372)
  D136  Are we already there? (D35A)
  D139  Yes, then set appropriate phase and exit >>D187
  D13D  Initialize phase count (halftracks) (D36B)
  D143  Preserve "current" track for comparisons (D371)
  D146  Subtract track to find to compute delta-tracks
  D147  Are we already there? (D372)
  D14A  Yes, then clear prior phase and exit >>D183
  D14C  Positive delta-tracks - go move arm out >>D155
  D14E  Negative delta-tracks - Get absolute value delta-tracks less 1
  D150  Increment current phase to move in (D35A)
  D153  Branch always taken >>D15A
  D155  Compute absolute value delta-tracks less 1
  D157  Decrement current phase to move out (D35A)
```

```
Disk 1I Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D15A
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

  D15A  Compare delta-tracks with phases moved (D36B)
  D15D  Use smaller value for offset to delay tables >>D162
  D162  Are we pointing at last table value yet?
  D164  Yes, then continue to use current offset >>D168
  D166  Else, use new offset
  D167  Set Carry flag for set phase operation
  D168  Set a phase  <D187>
  D16B  Get delay value from table (D373)
  D16E  Delay <D385>
  D171  Get prior phase number (D371)
  D174  Clear Carry flag for clear phase operation
  D175  Clear a phase <D18A>
  D178  Get delay value from table (D37C)
  D17B  Delay <D385>
  D17E  Increment phases moved (D36B)
  D183  Delay <D385>
  D187  Get "current" phase number (D35A)
  D18A  Use low two bits only, zero to three - 000000PP
  D18C  Multiply by two and bring in Carry   - 00000PPC
  D18D  Merge in slot number                 - 0SSS0PPC
  D18F  Put in X-reg for following operation
  D190  Toggle appropriate phase (C080)
  D193  Restore slot number to X-reg
  D195  Return to caller

D196 ********** TABLE 1 ************************************************
          Read Translate Table with Prenibblize
          Bit mask Tables and Epliog Table in
          unused areas

  D196    Read Translate

          Bit Mask 1
  D1A0  00000000
  D1A1  10000000
  D1A2  01000000
  D1A3  11000000

          Read Translate

          Bit Mask 2
  D1C0  00000000
  D1C1  00100000
  D1C2  00010000
  D1C3  00110000

          Epilog Table ($DE,$AA,$EB)
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D1C4
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

          Read Translate

          Bit Mask 3
  D1E0  00000000
  D1E1  00001000
  D1E2  00000100
  D1E3  00001100

          Read Translate

D200 ********** TABLE 2 ************************************************

          Write Translate Table
                  Every 4th byte starting at $D203

          Postnibblize Bit mask Tables
                  Bit mask 1 (Every 4th byte starting at $D200
                  Bit mask 2 (Every 4th byte starting at $D201
                  Bit mask 3 (Every 4th byte starting at $D202

  D200  Entry for Bit Mask 1
  D201  Entry for Bit Mask 2
  D202  Entry for Bit Mask 3
  D203  Entry for Write Translate

D300 ********** AUXILIARY BUFFER ***************************************

  D300  Auxiliary Buffer ($56 bytes) >>0056

D356 ********** VARIABLE AREA ******************************************

  D356  Track number
  D357  Sector number
  D358  Error number

          Disk Device Track Table
D359    Table Entry
  D359  Current Unit
  D35A  Current Track
  D35B  Slot 1, Devices 1 & 2
  D35D  Slot 2, Devices 1 & 2
  D35F  Slot 3, Devices 1 & 2
  D361  Slot 4, Devices 1 & 2
  D363  Slot 5, Devices 1 & 2
  D365  Slot 6, Devices 1 & 2
  D367  Slot 7, Devices 1 & 2
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D367
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D369  Retry count (initially 64)
  D36A  Recalibration count (initially 1)
D36B    Counter for Read Address routine
D36B    Temporary storage for Read Address routine
  D36B  Track counter for Arm Move routine
  D36C  Checksum computation
  D36D  Volume found
  D36E  Sector found
D36F    Delay counter (low byte)
  D36F  Track found
D370    Checksum found
  D370  Delay counter (high byte)
  D371  Prior Track
  D372  Track number for Arm Move routine

D373 ********** PHASEON/PHASEOFF TABLES ******************************

  D373  Phase on table (delays for disk head acceleration)

  D37C  Phase off table (delays for disk head deacceleration)

D385 ********** WAIT ROUTINE ****************************************

  D385  Wait about 100 times A-register (microseconds)
  D387  ---
  D392  ---
  D397  Return to caller

D398 ********** READ ADDRESS FIELD **********************************

  D398  Initialize "must find" count to $FCFC
  D39D  Increment count (low order byte) - Zero yet?
  D39E  No, skip ahead >>D3A5
  D3A0  Increment count (high order byte) - Zero yet? (D36B)
  D3A3  Yes, exit and indicate Read Error >>D3FB
  D3A5  Read data register  (C08C)
  D3A8  Loop until data valid >>D3A5
  D3AA  Is it first address mark ($D5)?
  D3AC  No, then increment "must find" count >>D39D
  D3AE  Delay for data latch to clear
  D3AF  Read data register (C08C)
  D3B2  Loop until data valid >>D3AF
  D3B4  Is it second address mark ($AA)?
  D3B6  No, then see if it's first address mark >>D3AA
  D3B8  Initialize count for four byte read
  D3BA  Read data register (C08C)
  D3BD  Loop until data valid >>D3BA
  D3BF  Is it third address mark ($96)?
  D3C1  No, then see if it's first address mark >>D3AA
  D3C3  Set Interupt flag
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D3C4
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D3C4  Initialize checksum
  D3C9  Read "odd" encoded byte     1X1X1X1X (C08C)
  D3CE  Align "odd" bits            X1X1X1X1
  D3CF  Save for later (D36B)
  D3D2  Read "even" encoded byte    1X1X1X1X (C08C)
  D3D7  Combine bytes               XXXXXXXX (D36B)
  D3DA  Preserve data (Volume,Track,Sector,Checksum) (D36D)
  D3DD  Do checksum computation (D36C)
  D3E0  Decrement counter - Finished field yet?
  D3E1  No, do some more >>D3C6
  D3E3  Is checksum computation zero?
  D3E4  No, then exit with carry set >>D3FB
  D3E6  Read data register (C08C)
  D3E9  Loop until data valid >>D3E6
  D3EB  Is it first trailing byte ($DE)?
  D3ED  No, then exit with carry set >>D3FB
  D3EF  Delay for data latch to clear
  D3F0  Read data register (C08C)
  D3F3  Loop until data vaild >>D3F0
  D3F5  Is it second trailing byte ($AA)?
  D3F7  No, then exit with carry set >>D3FB
  D3F9  Clear the Carry flag (no error)
  D3FA  Return to caller
  D3FB  Set the Carry flag (error occured)
  D3FC  Return to caller

D3FD ********** READ DATA (ON THE FLY) ROUTINE  **********************

  D3FD  Convert slot number to an
  D3FE  absolute reference (i.e. $60 -> $EC)
  D400  Modify code for current slot number (D45A)
  D403  (i.e. $C08C,X -> $C0EC) (D473)
  D40F  Get data buffer pointers
  D413  Modify code for current Buffer address (D4AF)
  D416  Provides access to top 3rd of Buffer (D4B0)
  D41A  Subtract $54 from current address
  D41F  Modify code for current address - $54 (D497)
  D422  Provides access to middle 3rd of Buffer (D498)
  D426  Subtract $57 from current address
  D42B  Modify code for current address - $AB (D470)
  D42E  Provides access to bottom 3rd of Buffer (D471)

  D431  Initialize must find count at $20
  D433  Decrement count - More to do?
  D434  No, then exit >>D46D
  D436  Read data register (C08C)
  D439  Loop until data valid >>D436
  D43B  Is is 1st header mark ($D5)?
  D43D  No, then try again >>D433
  D43F  Delay for register to clear
  D440  Read data register (C08C)
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D443
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D443  Loop until data valid >>D440
  D445  Is is 2nd header mark ($AA)?
  D447  No, then see if it is 1st header mark >>D43B
  D449  Delay for register to clear
  D44A  Read data register (C08C)
  D44D  Loop until data valid >>D44A
  D44F  Is is 3rd header mark ($AD)?
  D451  No, then see if it is 1st header mark >>D43B
  D453  Initialize offset into data buffer
  D457  Initialize checksum
  D459  Read a data byte (C0EC)
  D45E  Translate it (D100)
  D461  Store it in Auxiliary buffer (D256)
  D464  Compute running checksum
  D466  Increment offset - More to do?
  D467  Yes, then continue >>D457
  D469  Reinitialize offset into data buffer
  D46B  Branch always taken >>D472
  D46D  Set carry flag indicating error
  D46E  Return to caller
  D46F  Store byte in Primary buffer (bottom third) (1000)
  D472  Read a data byte (C0EC)
  D477  Translate it and merge in (D100)
  D47A  bits from Auxiliary buffer (D256)
  D480  Increment offset - done yet?
  D481  No, then do another >>D46F
  D483  Save last byte for later, no time now
  D484  Strip off last two bits   XXXXXX00
  D486  Reinitialize offset
  D488  Read a byte (C0EC)
  D48D  Translate it and merge in (D100)
  D490  bits from Auxiliary buffer (D256)
  D496  Store byte in Primary buffer (middle third) (1000)
  D499  Increment offset - done yet?
  D49A  No, then do another >>D488
  D49C  Read a byte  (C0EC)
  D4A1  Strip off last two bits   XXXXXX00
  D4A3  Reinitialize offset
  D4A5  Translate byte and merge in (D100)
  D4A8  bits from Auxiliary buffer (D254)
  D4AE  Store byte in Primary buffer (top third) (1000)
  D4B1  Read a byte (C0EC)
  D4B6  Increment offset - done yet?
  D4B7  No, then do another >>D4A5
  D4B9  Strip off last two bits   XXXXXX00
  D4BB  Is checksum valid? (D100)
  D4BE  No, then exit with error >>D4CC
  D4C0  Get slot number
  D4C2  Read data register (C08C)
  D4C5  Loop until data valid >>D4C2
  D4C7  Is is 1st trailing mark ($DE)?
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D4CA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D4CA  Yes, then continue with carry clear >>D4CD
  D4CC  Set Carry flag indicating error
  D4CD  Get byte we stored away, we have time now
  D4CE  Set proper offset
  D4D0  Store byte in Primary buffer (offset $55)
  D4D2  Return to caller

D4D3 ********** UPDATE DEVICE TRACK TABLE ****************************

  D4D3  Get offset into Device Track Table <D4F1>
  D4D6  Update Device Track Table (D359)
  D4D9  Return to caller

D4DA ********** DETERMINE IF DRIVE IS ON (DATA CHANGING)**************

  D4DA  Get slot number
  D4DC  Initialize counter
  D4DE  Read data register (C08C)
  D4E1  Delay 25 cycles <D4F0>
  D4E6  Has data register changed? (C08C)
  D4E9  Yes, then exit >>D4F0
  D4EB  Just in case indicate No Device Connected Error
  D4ED  Decrement count - 256 tries yet?
  D4EE  No, try again >>D4DE
  D4F0  Return to caller

D4F1 ********** CONVERT SLOT/DRIVE TO TABLE OFFSET *******************

  D4F1  Preserve A-register
  D4F2  Get Unit number       DSSS0000
  D4F4  Divide by 16          0000DSSS
  D4F8  Put Drive into Carry  0000DSSS  D
  D4FA  Strip out Drive       00000SSS  D
  D4FC  Roll left             0000SSSD
  D4FD  Put result in X-register
  D4FE  Restore A-register
  D4FF  Return to caller

D500 ********** WRITE DATA ROUTINE ***********************************

  D500  Set Carry flag (anticipate error)
  D504  Is diskette "write-protected"? (C08E)
  D507  No, then continue on >>D50C
  D509  Go to error routine >>D5DF
  D50C  Put transition byte from secondary buffer (D300)
  D50F  into zero page for timing
  D511  Use $FF for "sync" byte
  D513  Write first "sync" byte (C08F)
  D519  Set counter for four more
  D51C  Delay so that writes occur
  D51D  Exactly on 40 cycle loops
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D51E
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D51E  ---
  D520  Write "sync" byte <D5E7>
  D523  Decrement counter, done yet?
  D524  No, then do another >>D51E
  D526  Write first data mark ($D5)
  D52B  Write second data mark ($AA)
  D530  Write third data mark ($AD)
  D535  Initialize checksum
  D536  Initialize index into Auxiliary buffer
  D538  Branch always taken >>D53D
  D53A  Get data byte (Auxiliary buffer) (D300)
  D53D  Exclusive-or with previous data byte (D2FF)
  D540  Put result in X-reg for table lookup
  D541  Lookup "disk byte" in table (D203)
  D544  Get slot
  D546  Write "disk byte" (C08D)
  D54C  Decrement index - Done with Auxiliary buffer?
  D54D  No, then another byte >>D53A
  D54F  Get last byte of Auxiliary buffer
  D551  Initialize index into Primary buffer
  D553  Exclusive-or with next data byte (1000)
  D556  Strip out last two bits  XXXXXX00
  D558  Put result in X-reg for table lookup
  D559  Lookup "disk byte" in table (D203)
  D55C  Get slot
  D55E  Write "disk byte" (C08D)
  D564  Get data byte (Primary buffer) (1000)
  D567  Increment offset, end of this page?
  D568  No, then continue on >>D553
  D56A  Did buffer start on page boundary?
  D56C  Yes, then go write checksum >>D5C0
  D56E  Did buffer start one past page boundary?
  D570  Yes, then go write last byte >>D5B3
  D572  Carry indicates odd or even buffer end
  D573  Get transition byte
  D575  Write it  (C08D)
  D57B  Get second transition byte
  D57D  Delay 2 cycles for correct timing
  D57E  Increment offset, buffer end on odd byte?
  D57F  Yes, go see if we're done then >>D599
  D581  Exclusive-or with next data byte (1100)
  D584  Strip out last two bits  XXXXXX00
  D586  Put result in X-reg for table lookup
  D587  Lookup "disk byte" in table (D203)
  D58A  Get slot
  D58C  Write "disk byte" (C08D)
  D592  Get data byte (Primary buffer - page 2) (1100)
  D595  Increment offset
  D596  Exclusive-or with next data byte (1100)
  D599  End of buffer? - Put result in carry
  D59B  Strip out last two bits  XXXXXX00
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D59D
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D59D  Put result in X-reg for table lookup
  D59E  Lookup "disk byte" in table (D203)
  D5A1  Get slot
  D5A3  Write "disk byte" (C08D)
  D5A9  Get data byte (Primary buffer - page 2) (1100)
  D5AC  Increment offset - Done yet?
  D5AD  No, then do another >>D581
  D5AF  Yes, then go write checksum >>D5B1
  D5B1  --- >>D5C0
  D5B3  Get last byte
  D5B6  Write it (C08D)
  D5BC  Delay 14 cycles for correct timing
  D5C0  Use last byte in Primary buffer as checksum
  D5C2  Lookup "disk byte" (D203)
  D5C5  Get slot
  D5C7  Write "disk byte" (C08D)
  D5CD  Initialize offset into "epilog" table
  D5CF  Delay 11 cycles for correct timing
  D5D3  Load "epilog" from table ($DE,$AA,$EB,$FF) (D1C4)
  D5D6  Go write it <D5E9>
  D5D9  Increment offset
  D5DA  Done all four yet?
  D5DC  No, then do another >>D5D3
  D5DE  Clear Carry flag (no error)
  D5DF  Select read mode (C08E)
  D5E5  Return to caller

D5E6 ********** WRITE A BYTE SUBROUTINE ******************************

  D5E6  Wait 9 cycles before write
  D5E7  Wait 7 cycles before write
  D5E9  Put A-register in data register (C08D)
  D5EC  And write data register (C08C)
  D5EF  Return to caller

D5F0 ********** PRENIBLIZE BLOCK ROUTINE ******************************

  D5F0  Get buffer pointer
  D5F5  Add $2 to buffer address
  D5F7  To access top third of buffer >>D5FA
  D5FA  Store result in code below (D630)
  D601  Subtract $54 from buffer address
  D603  To access middle third of buffer >>D606
  D606  Store result in code below (D625)
  D60D  Subtract $AA from buffer address
  D60F  To access bottom third of buffer >>D612
  D612  Store result in code below (D61B)
  D618  Initialize offset
  D61A  Get data byte (bottom third)    XXXXXXXX (1000)
  D61D  Get last two bits               000000AB
  D61F  Put in X-reg for table lookup
```

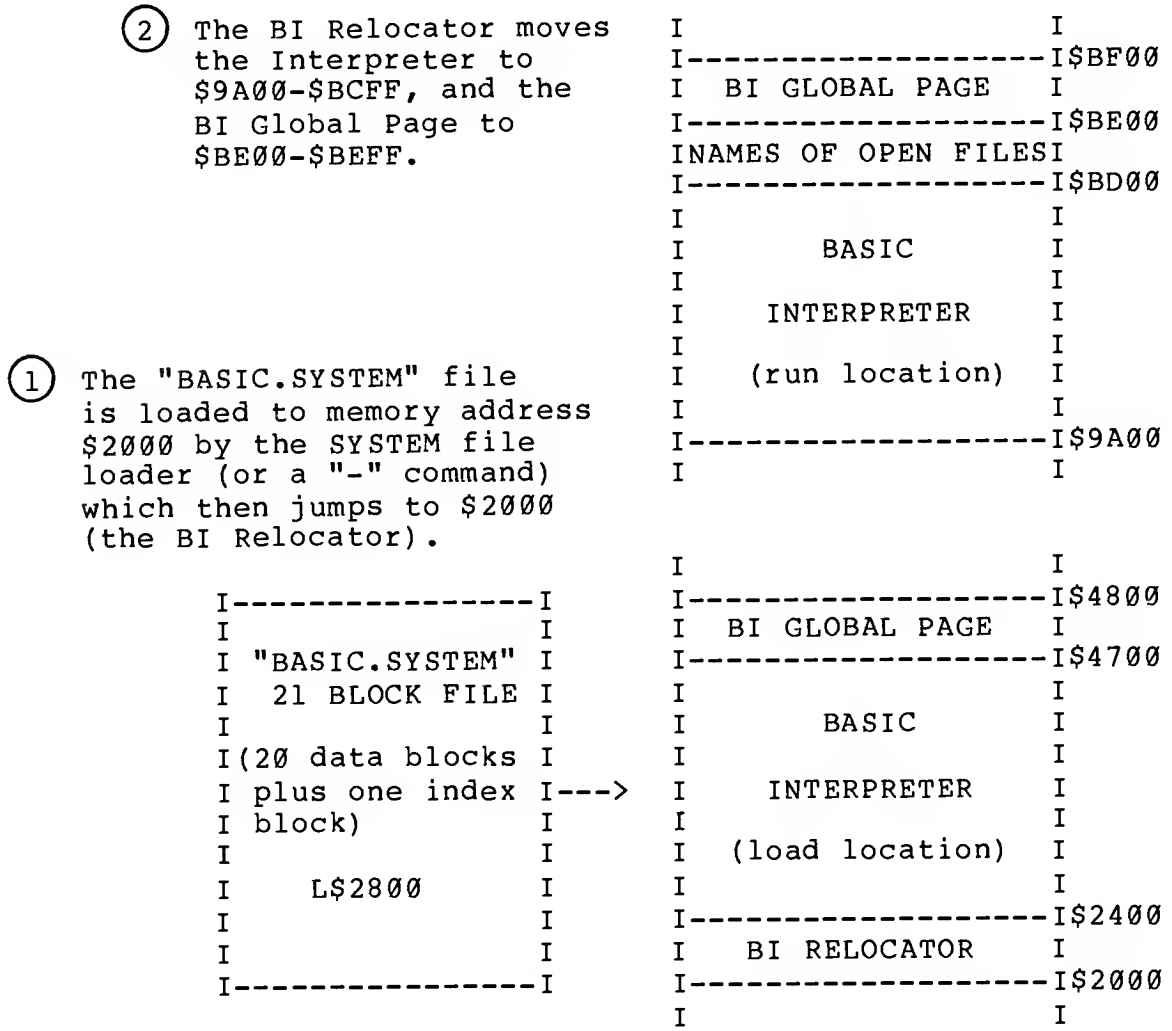
```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D620
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D620  Use lookup to reposition bits   0000BA00 (D1E0)
  D623  Save result on stack
  D624  Get data byte (middle third)    XXXXXXXX (1056)
  D627  Get last two bits               000000CD
  D629  Put in X-reg for table lookup
  D62A  Get current value from stack    0000BA00
  D62B  Merge in new bits using table   00DCBA00 (D1C0)
  D62E  Save result on stack
  D62F  Get data byte (top third)       XXXXXXXX (10AC)
  D632  Get last two bits               000000EF
  D634  Put in X-reg for table lookup
  D635  Get current value from stack    00DCBA00
  D636  Merge in new bits using table   FEDCBA00 (D1A0)
  D639  Save result on stack
  D63A  Get offset into primary buffer
  D63B  Compute offset into Auxiliary buffer
  D63D  Put in X-reg
  D63E  Get data byte just created      FEDCBA00
  D63F  Store it in Auxiliary buffer (D300)
  D642  Increment offset primary buffer, done yet?
  D643  No, then do another >>D61A
  D645  Get low order byte of buffer
  D647  Subtract 1 (offset to last byte in buffer)
  D648  Save it for later
  D64A  Get low order byte of buffer
  D64C  Modify code in Write Data Routine (offset) (D552)
  D64F  Buffer on page boundary? - Yes, skip ahead >>D65F
  D651  Else, compute offset to last byte
  D653  Before page boundary
  D654  Get byte (page boundary -1)
  D656  Point at next byte (page boundary)
  D657  Exclusive-or them together      XXXXXXXX
  D659  Strip off last two bits         XXXXXX00
  D65B  Put in X-reg for table lookup
  D65C  Get "disk byte" from table (transition byte) (D203)
  D65F  Save result (0 indicates page boundary)
  D661  Buffer on page boundary? - Yes skip ahead >>D66F
  D663  Get offset to last byte in buffer
  D665  Carry indicates odd or even buffer start
  D666  Get byte (page boundary)
  D668  Did buffer start on odd byte? - Yes skip >>D66D
  D66A  Point at next byte (page boundary +1)
  D66B  Exclusive-or them together
  D66D  Save result
  D66F  Point at last byte in buffer
  D671  Get last byte in buffer         XXXXXXXX
  D673  Strip off last two bits         XXXXXX00
  D675  Save result ("checksum byte")
  D677  Get high order byte of buffer
  D679  Modify code in Write Data Routine (D555)
  D68C  Get slot number for this operation
```

```
Disk II Device Driver -- V1.1.1 -- 18 SEP 84    NEXT OBJECT ADDR: D68E
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D68E  Modify code in Write Data Routine (D55D)
  D69A  Return to caller

D69B ********** DETERMINE IF SLOT/DRIVE HAS CHANGED ******************

  D69B  Compare unit number with "current" unit number (D359)
  D69E  Put "current" drive in Carry
  D69F  Has slot changed? - No, then exit >>D6BD
  D6A9  Get "current" slot
  D6AB  Put in X-register
  D6AC  Exit if Slot 0 >>D6BD
  D6AE  Is "current" motor is on? <D4DC>
  D6B1  No, then exit >>D6BD
  D6B8  Wait until "current" motor is off (D370)
  D6BB  Or else timeout >>D6A6
  D6BD  Return to caller

D6BE *********** CLEAR IWM PHASES ************************************

  D6BE  Get unit number
  D6C0  Strip drive bit
  D6C2  Put slot*16 in X-Register
  D6C3  Clear phases in case there is (C080)
  D6C6  one of them new-fangled storage  (C082)
  D6C9  devices sharing this slot (C084)
  D6CC  with my (t)rusty old Disk II. (C086)
  D6CF  Return to caller

D6D0 *********** CHECK CALLING PARAMETERS ****************************

  D6D0  Check command code
  D6D2  Is it greater or equal to 4?
  D6D6  Get Block Number
  D6DA  Is Block Number good? (D356)
  D6DD  Yes, if less than $100 >>D6E8
  D6E0  No, if greater than or equal to $200 >>D6E6
  D6E4  No, if greater than or equal to $118 >>D6E8
  D6E6  Indicate error
  D6E7  Return to caller
  D6E8  All is well
  D6E9  Return to caller

D6EA *********** $D6EA-$D6FF NOT USED *********************************

  D6EA  Not used
```

```
IRQ Handler -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: FF9B
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

FF9B    MODULE STARTING ADDRESS
            ************************************
            *                                  *
            * IRQ Handler                      *
            *     Resides at $FF9B.  Put       *
            *     there by ProDOS Relocator.   *
            *                                  *
            * VERSION 1.1.1 -- 18 SEP 84       *
            * (The IRQ Handler is still the    *
            *  same as it was in Version 1.Ø.1) *
            *                                  *
            ************************************

FF9B ********** GLOBAL PAGE EQUATES **********************************

BF56    Temporary storage 1
BF57    Temporary storage 2
BF88    A register savearea
BF8D    Bank ID byte
BFD3    IRQ exit code

FF9B ********** EXTERNAL EQUATES **************************************

DØØØ    RAM/ROM test byte
CØ82    ROM Select
CØ8B    BANK1 Select

FF9B ********** IRQ CODE *********************************************

  FF9B  Put A-Register on stack
  FF9C  Get Accumulator value from $45
  FF9E  and save it (BF56)
  FFA1  Replace $45 with A-Register
  FFA2  since it may have been destroyed
  FFA4  Load Status register
  FFA5  Restore onto stack
  FFA6  Isolate B flag - Was it a BRK?
  FFA8  Yes, skip Interrupt stuff >>FFC2
  FFAA  Else, Check location $DØØØ (DØØØ)
  FFAD  Do we have RAM active
  FFAF  Yes, indicate so >>FFB3
  FFB1  Else, indicate ROM
  FFB3  Update Bank ID byte (BF8D)
  FFB6  Also save temporarily (BF57)
  FFB9  Push ($BF5Ø) address of
  FFBB  routine to bank in Ram and
  FFBC  call IRQ on the stack
  FFBF  Push a new P-Register on stack with
  FFC1  the Interrupt Disable flag set
  FFC2  Push ($FA41) address less 1 of
  FFC4  Monitor IRQ on the stack
```

```
IRQ Handler -- V1.1.1 -- 18 SEP 84              NEXT OBJECT ADDR: FFC8
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  FFC8  Select ROM - execution continues in ROM (CØ82)

            ******* RESET CODE ***************

  FFCB  Push ($FA61) address less 1 of (FFD7)
  FFCE  Hardware Reset routine on to stack
  FFD3  Exit via select ROM code above >>FFC8

  FFD6  Address (-1) of Hardware Reset routine

            ******* IRQ CODE *****************
          Called via $BF5Ø in System Global Page

  FFD8  Save Accumulator in Global page (BF88)
  FFDB  Restore $45 with original value (BF56)
  FFEØ  Select RAM (read & write) (CØ8B)
  FFE3  use BANK1 (CØ8B)
  FFE6  Get Bank ID byte (BF57)
  FFE9  Leave via Global Page IRQ exit code >>BFD3

FFEC ********** $FFEC-$FFF9 UNUSED **********************************

  FFEC  These unused bytes are at $4FEC-$4FF9 when
  FFF9  loaded as part of the "PRODOS" file.

FFFA ********** VECTORS ***********************************************

  FFFA  NMI Vector
  FFFC  Reset Vector
  FFFE  IRQ Vector
```

HOW "BASIC.SYSTEM" IS LOADED AND RELOCATED



```
BI Relocator -- V1.I.I -- I8 JUN 84            NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

2000    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS BASIC INTERPRETER RELOCATOR  *
          *       LOADED AS THE FIRST TWO BLOCKS *
          *       OF BASIC.SYSTEM AT $2000.      *
          *       THIS ROUTINE MOVES THE BASIC   *
          *       INTERPRETER TO $9A00-$BCFF.    *
          *                                      *
          *  FOR PRODOS VERSION I.1.I            *
          *  (BASIC Version Number is I.1,       *
          *   Modify date is 18 JUN 84)          *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0000    "FROM" POINTER FOR COPY
000I
0002    "TO" POINTER FOR COPY
0003
0036    CSWL VECTOR
0038    KSWL VECTOR
006F    APPLESOFT START OF STRINGS
0073    APPLESOFT HIMEM
00F2    APPLESOFT TRACE FLAG

          ******** EXTERNAL ADDRESSES *************

0200    PATHNAME BUFFER
0280    PREFIX BUFFER
028I    START OF PREFIX NAME

03D0    WARMSTART VECTOR
03D3    COLDSTART VECTOR
03F0    BRK HANDLER ADDRESS
03FI
03F2    RESET HANDLER ADDRESS
03F3
03F4    POWER-UP BYTE
03F5    APPLESOFT & VECTOR
03F8    CTL-Y VECTOR

          ******** SCREEN LINE ADDRESSES **********

0400    FIRST SCREEN BUFFER LINE
0480    SCREEN BUFFER LINE
0628    SCREEN BUFFER LINE
```

```
BI Relocator -- VI.I.I -- I8 JUN 84            NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

          ******** BASIC GLOBAL PAGE **************

BC7A    BASIC INTERPRETER VERSION NUMBER
BE00    BASIC INTERPRETER ENTRY POINT
BE03    BI COMMAND SCANNER (SYNTAX)
BEI0    COUT VECTORS FOR EACH SLOT
BE20    KSWL VECTORS FOR EACH SLOT
BE3C    DEFAULT SLOT NO.
BE3D    DEFAULT DRIVE NO.
BEFB    HIMEM

          ******** SYSTEM GLOBAL PAGE *************

BF00    MACHINE LANGUAGE INTERFACE ENTRY
BF30    LAST DEVICE USED
BF58    MEMORY MAP
BF98    MACHINE TYPE FLAGS
BF99    SLOTS WHICH CONTAINS CARDS WITH ROM
BF9A    IF 0, NO PREFIX ACTIVE
BFFD    INTERPRETER VERSION NUMBER

          ******** ROM ADDRESSES ******************

E000    APPLESOFT ENTRY POINT
FA59    BRK HANDLER
FB2F    INIT SCREEN, MONITOR, ETC.
FC58    CLEAR SCREEN, HOME CURSOR
FDED    STANDARD CHARACTER OUT
FDF0    CHARACTER OUTPUT TO SCREEN
FE84    SET NORMAL CHARACTER ATTRIBUTE

2000 *********** BASIC INTERP RELOCATOR ENTRY ************************

  2000  JUMP OVER STARTUP FILENAME >>2047
  2006  STARTUP FILENAME LENGTH (7)
  2007  'STARTUP'
  200E  ALLOW FOR 64 CHAR FILENAME

  2047  $00 --> $2400
  204B  $02 --> $9A00
  2055  COPY 35 PAGES
  2058  COPY INTERP TO HIGH MEMORY AT $9A00 <20C4>
  205D  PAGE FOLLOWING INTERP IMAGE IS...
  205F  BASIC GLOBAL PAGE IMAGE
  2061  COPY THAT TO $BE00 <20C4>
  2064  TO GET 40-COL DISPLAY, SEND A CTRL-U
  2066  OUT THE NORMAL OUTPUT VECTOR. <FDED>
  2069  SET NORMAL CHARACTER ATTRIBUTE <FE84>
  206C  INITIALIZE SCREEN/WINDOW <FB2F>
  206F  CLEAR SCREEN/HOME CURSOR <FC58>
```

```
BI Relocator -- V1.1.1 -- 18 JUN 84            NEXT OBJECT ADDR: 2076
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2076  SET BITMAP TO MARK LOWER 48K FREE (BF58)
  207C  EXCEPT PAGES Ø AND 1 AND
  207E   TEXT PAGES 4 THROUGH 7 (BF58)
  2086  MARK $9000-$BFFF IN USE..
  2091  EXCEPT FOR $BA00-$BDFF ARE FREE
  2096  LOOK AT LANGUAGE IN ROM (E000)
  2099  IS IT APPLESOFT?
  209B  NO, THEN CAN'T RUN INTERP >>20B1
  20A0  GOT AT LEAST 64K?
  20A2  NO, THIS ONLY WORKS IN 64K >>20B1
  20A6  SET MY CSWL/KSWL FOR INTERP INIT (221A)
  20AC  COPY ALL 4 BYTES >>20A6
  20AE  THEN GO TO BASIC COLDSTART >>E000
          (WE WILL GET CONTROL AT $20D4 AGAIN)

20B1 *********** ERROR EXIT ****************************************

  20B1  ---
  20B3  PRINT "UNABLE TO EXECUTE BASIC SYSTEM" (223F)
  20BC  ALLOW REBOOT IF RESET PRESSED (03F4)
  20C2  GO TO SLEEP FOREVER >>20C2

20C4 *********** COPY PAGES ($0/1-->$2/3) ****************************

  20C4  ---
  20C5  COPY FROM $0/1
  20C7  TO $2/3
  20CA  A PAGE AT A TIME >>20C4
  20D0  COUNT PAGES
  20D3  RETURN

20D4 *********** CSWL INTERCEPT / CONTINUE ***************************

  20D4  "]" APPLESOFT PROMPT?
  20D6  NO...DON'T PRINT WHATEVER IT IS >>20D3
  20D8  YES, APPLESOFT DONE SETTING UP (BE10)
  20DB  POINT CSWL TO STANDARD OUTPUT
  20E2  CHECK LAST DEVICE USED (BF30)
  20E5  SET ONLINE PARAMETER TO THIS (2238)
  20EB  DRIVE ONE OR TWO? >>20EE
  20EE  STORE DEFAULT DRIVE (D) (BE3D)
  20F2  ISOLATE SLOT FROM DEVICE NO.
  20F7  AND STORE DEFAULT SLOT (S) (BE3C)
  20FE  GET SLOT BYTE SHOWING CARDS PRESENT (BF99)
  2102  PICK OFF ITS BITS ONE BY ONE
  2108  SET OUTVECS AND INVECS TO $CS00 (BE10)
  210B  FOR ALL SLOTS WITH ROMS IN THEM (BE20)
  2115  ---
  211B  SET HIMEM TO $9600
  211D  IN VARIOUS PLACES
  2124  GOT A DEFAULT PREFIX? (BF9A)
```

```
BI Relocator -- V1.1.1 -- 18 JUN 84            NEXT OBJECT ADDR: 2127
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2127  NO >>214E
  2129  YES, MLI: GET PREFIX <BF00>
  212F  ERROR? >>218B
  2136  BACKSCAN PREFIX FOR "/"'S (0280)
  213B  AND COUNT THEM IN $21EE (223E)
  213E  ---
  213F  FOR A COUNT OF SUBLEVELS >>2136
  2146  MORE THAN JUST VOLUME NAME? >>216F
  2148  NO, MLI: SET PREFIX <BF00>
  214E  MLI: ONLINE <BF00>
  2154  ERROR? >>218B
  2156  GET VOL NAME LENGTH (0281)
  215B  NONE THERE? >>218B
  215F  ADD ONE TO NAME LENGTH (0280)
  2164  AND PREFIX IT WITH A "/" (0281)
  2167  MLI: SET PREFIX <BF00>
  216D  ERROR? >>218B

        ******** FIND STARTUP FILE **************

  216F  MLI: GET_FILE_INFO <BF00>
  2172  FIND "STARTUP" FILE
  2175  ERROR? >>218B
  217A  SAVE LENGTH OF STARTUP FILE NAME (2236)
  217D  COPY NAME TO $200 (2006)
  2186  FIRST COMMAND WILL BE "-STARTUP"
  218B  CHECK NUMBER OF SUBLEVELS (223E)
  2190  MORE THAN JUST VOL? >>2198
  2192  MLI: SET PREFIX <BF00>
  2198  ANY STARTUP FILE NAME? (2236)
  219B  YES, SKIP MESSAGE >>21C1
  219D  SET TRUE KSWL <2209>
  21A2  PRINT '          PRODOS BASIC 1.1' (2267)
  21AD  PRINT '       COPYRIGHT ... (2283)
  21B6  SKIP THREE LINES

        ******** FINISH UP AND GO TO BI *********

  21C1  ---
  21C3  COPY WARMSTART JMP TO PAGE 3 (21FF)
  21C9  AND COLDSTART (03D3)
  21CC  AND CTL-Y (03F8)
  21CF  POINT & VECTOR (2206)
  21D2  TO $BE03 (CMD SCANNER) (03F5)
  21D8  COPY BRK HANDLER JMP ALSO (2202)
  21E7  AND RESET JMP (03F2)
  21F2  SET POWER-UP BYTE ACCORDINGLY (03F4)
  21F7  SET APPLESOFT IN NON-TRACE MODE
  21F9  GET INTERPRETER VERSION NUMBER, (BC7A)
  21FC  PUT IT IN SYSTEM GLOBAL PAGE. (BFFD)
  21FF  GO TO INTERPRETER >>BE00
```

```
B1 Relocator -- V1.1.1 -- 18 JUN 84            NEXT OBJECT ADDR: 21FF
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

         ******** VECTOR ADDRESSES ***************

  2202  BREAK HANDLER ADDRESS FOR PAGE 3
  2204  RESET HANDLER IS BASIC INTERP
  2206  APPLESOFT & GOES TO B1 CMD SCANNER >>BE03

2209 *********** FIRST KSWL INTERCEPT *********************************

  2209  SET KSWL TO CURRENT DEVICE HANDLER (BE20)
  2213  RETURN LENGTH OF FIRST COMMAND (2006)
  2217  FOLLOWED BY A RETURN
  2219  RETURN

221A *********** DATA ************************************************

  221A  CSWL (20D4) INTERCEPT ADDR
  221C  KSWL (2209) INTERCEPT ADDR

  221E  GET FILE INFO PARMLIST
  221F  FILE NAME IS AT $2006
  2221  15 BYTES RESERVED FOR OTHER GET_FILE PARMS (NOT USED)
  2230  THIS BYTE NOT USED

  2231  SET PREFIX PARM LIST
  2232  FOR PREFIX AT $2234

  2234  NULL PREFIX
  2235  "/"

  2236  SAVED LENGTH OF STARTUP FILE NAME

  2237  ONLINE PARM LIST
  2239  PUT VOLUME NAME AT $281

  223B  SET PREFIX PARMLIST
  223C  PREFIX IS AT $280

  223E  NUMBER OF SUBLEVELS IN PREFIX +1

  223F  '***  UNABLE TO EXECUTE BASIC SYSTEM  ***'
  2267  '            PRODOS BASIC 1.1'
  2283  '        COPYRIGHT APPLE, 1983-84'

22A3 *********** $22A3-$23FF NOT USED *********************************

  22A3  NOT USED
```

```
B1 Relocator -- V1.1.1 -- 18 JUN 84            NEXT OBJECT ADDR: 22A5
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

2400 *********** START OF B1 IMAGE ************************************

2400    BASIC INTERP IMAGE
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9A00
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

9A00    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS BASIC INTERPRETER (BI)       *
          *       THIS CODE STARTS IN THE THIRD  *
          *       BLOCK OF THE FILE BASIC.SYSTEM.*
          *       IT PERFORMS COMMAND HANDLING   *
          *       FOR ALL BUILT-IN PRODOS COM-   *
          *       MANDS AND SUPPORTS BASIC'S FILE*
          *       HANDLING.                      *
          *                                      *
          *  VERSION 1.1 -- 18 JUN 84            *
          *    DISTRIBUTED WITH PRODOS V1.1.1    *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0024    CURSOR HORIZONTAL
0028    SCREEN LINE BASE ADDR
0029
0033    MONITOR PROMPT CHARACTER
0036    CRT DISPLAY VECTOR (CSWL)
0037
0038    KEYBOARD INPUT VECTOR (KSWL)
0039
003A    SCRATCH POINTER AND LOOP COUNTER
003B
003C    SCRATCH POINTER AND LOOP COUNTER
003D
003E    POINTER TO APPLESOFT VARIABLES
003F
0050    APPLESOFT: LINE NUMBER
0051
0067    APPLESOFT: START OF PROGRAM PTR
0068
0069    APPLESOFT: LOMEM (START OF VARS)
006A
006B    APPLESOFT: START OF ARRAY VARS PTR
006C
006E    APPLESOFT: START OF FREEAREA PTR
006D
006F    APPLESOFT: START OF STRINGS PTR
0070
0073    APPLESOFT: HIMEM (END OF STRINGS)
0074
0075    APPLESOFT: CURRENT LINE BEING EXECUTED
0076
009B    APPLESOFT: ADDR OF LINE AFTER FINDLINE
009C
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9A00
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

00AF    APPLESOFT: END OF PROGRAM PTR
00B0
00B8    APPLESOFT: START OF PROGRAM PTR
00B9
00D6    APPLESOFT: PROGRAM LOCKED (PROTECTED)
00D8    APPLESOFT: ONERR ACTIVE FLAG
00DE    APPLESOFT: ONERR CODE
00F2    APPLESOFT: TRACE ACTIVE FLAG
00F8    APPLESOFT: INTERNAL STACK

          ******** EXTERNAL ADDRESSES *************

0100    START OF 6502 STACK
0200    KEYBOARD INPUT LINE BUFFER
03F4    POWERON RESET FLAG

          ******** BI GLOBAL PAGE *****************

BE06    EXTERNAL COMMAND ENTRY TO BI
BE0C    PRINT ERROR MESSAGE ENTRY TO BI
BE0F    PRODOS ERROR CODE
BE10    OUTPUT VECTORS FOR ALL SLOTS
BE30    CURRENT OUTPUT VECTOR
BE32    CURRENT INPUT VECTOR
BE34    PRODOS INTERCEPT VECTORS (INPUT/OUTPUT)
BE38    BI'S INTERNAL REDIRECTION VECTORS
BE3C    DEFAULT SLOT
BE3D    DEFAULT DRIVE
BE3E    A REGISTER SAVE AREA
BE3F    X REGISTER SAVE AREA
BE40    Y REGISTER SAVE AREA
BE41    TRACE FLAG (APPLESOFT TRACE ON/OFF)
BE42    IMMEDIATE COMMANDS=0, DEFERRED=1
BE43    EXEC FILE ACTIVE=$80
BE44    READ FILE ACTIVE=$80
BE45    WRITE FILE ACTIVE=$80
BE46    READING PREFIX ACTIVE=$80
BE47    DIRECTORY FILE BEING ACCESSED
BE49    FREE STRING SPACE DURING GARBAGE COLLECT
BE4A    BUFFERED I/O BYTE COUNT
BE4B    INDEX INTO INPUT COMMAND LINE
BE4C    LAST OUTPUT CHAR TO PREVENT RECURSION
BE4D    NUMBER OF OPEN NON-EXEC FILES
BE4E    EXEC FILE BEING CLOSED FLAG
BE4F    READ FILE IS TRANSLATED DIRECTORY
BE50    VECTOR TO EXTERNAL COMMAND HANDLER
BE52    LENGTH-1 OF EXTERNAL COMMAND STRING
BE53    COMMAND NUMBER
BE54    PARAMETERS ALLOWED FOR THIS COMMAND
          (SEE BIT DEFINITIONS IN TABLE LATER)
BE56    PARAMETERS FOUND WITH THIS COMMAND
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9A00
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

          (SAME BIT DEFINITIONS AS FOR PBITS)
BE58    A KEYWORD VALUE
BE5A    B KEYWORD VALUE
BE5D    E KEYWORD VALUE
BE5F    L KEYWORD VALUE
BE61    S KEYWORD VALUE
BE62    D KEYWORD VALUE
BE63    F KEYWORD VALUE
BE65    R KEYWORD VALUE
BE68    @ KEYWORD VALUE
BE6A    T KEYWORD VALUE
BE6B    SLOT NUMBER FROM IN# OR PR#
BE70    ISSUE MLI CALL AND XLATE ERROR CODES
          MLI PARM LIST FIELDS
BEA3    CREATE: ACCESS CODE
BEA4    CREATE: FILE ID
BEA5    CREATE: AUX ID
BEA7    CREATE: FILE KIND
BEB4    SET/GET FILE INFO: PARM COUNT
BEB7    SET/GET FILE INFO: ACCESS CODE
BEB8    SET/GET FILE INFO: FILE ID
BEB9    SET/GET FILE INFO: AUX ID
BEBB    SET/GET FILE INFO: FILE KIND
BEBC    SET/GET FILE INFO: BLOCKS USED
BEBE    SET/GET FILE INFO: MODIFY DATE/TIME
BEC7    ONLINE/GET/SET MARK/EOF/BUF: REF NUM
BEC8    ONLINE/GET/SET MARK/EOF/BUF: MARK/BUF
BECE    OPEN: SYSTEM BUFFER
BED0    OPEN: REF NUM RETURNED
BED2    NEWLINE: REF NUM
BED3    NEWLINE: NEW LINE CHAR (ALWAYS CR)
BED6    READ/WRITE: REF NUM
BED7    READ/WRITE: DATA ADDRESS
BED9    READ/WRITE: LENGTH OF DATA
BEDB    READ/WRITE: ACTUAL LENGTH TRANSMITTED
BEDE    CLOSE/FLUSH: REF NUM
BEFB    BASIC HIMEM VALUE

          ******** SYSTEM GLOBAL PAGE *************

BF03    QUIT VECTOR
BF30    LAST DEVICE USED
BF58    MEMORY UTILIZATION BIT MAP
BF94    OPEN FILE LEVEL
BF9A    PREFIX ACTIVE FLAG (IF NONZERO)

          ******** INPUT/OUTPUT LOCATIONS *********
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9A00
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------


C000    KEYBOARD STROBE
C010    KEYBOARD STROBE CLEAR
CFFF    RESET I/O ROMS

          ******** APPLESOFT ROM LOCATIONS ********

D43F    APPLESOFT RESTART ENTRY
D61A    FIND LINE BY NUMBER IN APPLESOFT
D665    SET POINTERS IN APPLESOFT
D7D2    EXECUTE NEW APPLESOFT STATEMENT
D820    APPLESOFT CMD EXECUTE
D865    APPLESOFT SIGNAL ERROR
ED24    APPLESOFT PRINT DECIMAL NUMBER
F273    APPLESOFT SET NORMAL CHARS

          ******** MONITOR ROM LOCATIONS **********

FC58    MONITOR CLEAR SCREEN/HOME CURSOR
FC9C    MONITOR CLEAR TO EOL
FD10    MONITOR READ KEY (NO CURSOR)
FDED    COUT VECTOR

9A00 *********** BASIC INTERPRETER LOAD POINT ************************
          (ENTRY POINT IS AT $ABF1, WARMDOS)

9A00 *********** REMOVE KSWL/CSWL INTERCEPTS *************************

  9A00  ---
  9A01  REPLACE CSWL/KSWL WITH CURRENT (BE30)
  9A04  ACTUAL DEVICE DRIVER VECTORS
  9A16  RETURN

9A17 *********** RESET MODE/SET BI INTERCEPTS ************************

  9A17  SET IMMEDIATE COMMAND MODE
  9A19  AND GO SET I/O VECTORS <9F76>
  9A1C  KSWL/H ALREADY SET?
  9A21  NO? THEN CHECK CSWL >>9A26
  9A23  YES, CONTINUE >>9AA3
  9A26  CSWL/H ALREADY SET?
  9A2B  YES, CONTINUE >>9AA3
  9A2D  NO, SAVE CURRENT INTERCEPTS FIRST >>9A8D

9A2F *********** OUTPUT INTERCEPT: MODE = 0 ***************************
          (IMMEDIATE MODE)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9A2F
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  9A2F  "#" CHARACTER? (9F61)
  9A32  NO... >>9A54
  9A34  ELSE, SAVE X REG (BE3F)
  9A38  CHECK STACK FOR $D812 AS RETURN ADDR (Ø1Ø3)
  9A3B  (APPLESOFT TRACE, PRINTING #LINENO)
  9A44  NOT TRACING? >>9A6E
  9A46  ELSE, SET DEFERED MODE=4
  9A4B  GET SET TO PRINT THE "#" (9F61)
  9A4E  RESTORE X REG (BE3F)
  9A51  AND GO TO OTHER OUTPUT HANDLER >>B7F1

  9A54  NOT A #, SAME AS LAST OUTPUT THO? (BE4C)
  9A57  (SAVE FOR NEXT TIME THRU) (BE4C)
  9A5A  NO, ALL IS WELL >>9A74
  9A5C  TWO RETURNS IN A ROW?
  9A5E  NO, ALL IS WELL >>9A74
  9A6Ø  HAS HORIZONTAL CURSOR POSN CHANGED?
  9A62  YES...  >>9A69
  9A64  ELSE, ANYTHING IN PATHNAME BUFFER? (BCBD)
  9A67  (MUST BE ALPHA)
  9A69  RESTORE A REG
  9A6B  PATHNAME IS THERE... >>9A74
  9A6D  ELSE, WE ARE RECURSING INFINITELY, EXIT!
  9A6E  WE WERE'NT TRACING AFTER ALL, RESTORE X (BE3F)
  9A71  AND A REGS, THEN FALL THRU TO EXIT (9F61)

9A74 *********** ECHO OUTPUT CHAR AND EXIT ***************************

  9A74  PUT BACK REAL CSWL/KSWL VECTORS <9AØØ>
  9A77  OUTPUT THE CHARACTER <FDED>
  9A7A  WAS IT A RETURN?
  9A7C  NO, EXIT NOW >>9A8D
  9A7E  ELSE, WAS APPLESOFT TRACING?
  9A82  YES >>9A8B
  9A84  NO, CLEAR MY TRACE FLAG (PSEUDO TRACE NOW) (BE41)
  9A87  FORCE APPLESOFT TO TRACE FOR MY BENEFIT ONLY
  9A8B  RESTORE A REG AND FALL THRU TO EXIT BI

9A8D *********** SAVE ACTUAL IN/OUT VECTORS ***************************

  9A8D  ---
  9A8E  COPY KSWL/H TO VECIN
  9A98  AND CSWL/H TO VECOUT
  9A9A  IN BI GLOBAL PAGE (BE31)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9AA3
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

9AA3 *********** SET CSWL/KSWL INTERCEPTS ****************************

  9AA3  ---
  9AA4  COPY VDOSIO VECTORS (BE34)
  9AA7  TO CSWL
  9AB1  AND KSWL
  9AB9  EXIT TO CALLER

9ABA *********** INPUT INTERCEPT: MODE = Ø ****************************
         (IMMEDIATE MODE)

  9ABA  IS EXEC FILE ACTIVE? (BE43)
  9ABD  NO >>9AC5
  9ABF  YES, SAVE REGISTERS <9F62>
  9AC2  AND GO READ EXEC FILE FOR INPUT COMMANDS >>9BAF

  9AC5  NO EXEC FILE, RESTORE REAL CSWL/KSWL <9AØØ>
  9AC8  NO, READ A KEY FROM KEYBOARD <FD1Ø>
  9ACB  RETURN?
  9ACD  NO, EXIT >>9AEB
  9ACF  YES, SAVE REGISTERS <9F62>
  9AD2  STORE IT IN LINE BUFFER (Ø2ØØ)
          --> THIS ENTRY CALLED BY EXEC TO PROCESS
              A COMMAND STRING STORED AT $2ØØ
  9AD5  GO PROCESS THE COMMAND STRING <A677>
  9AD8  CHECK COMMAND NUMBER RETURNED FROM PARSE (BE53)
  9ADB  EXIT BI RIGHT NOW? >>9AE8
  9ADD  NO, COMMAND RETURNED WITH ERROR CODE? >>9AFØ
  9ADF  NO, RESTORE Y REG (BE4Ø)
  9AE2  RETURN A BACKSPACE TO CALLER OF KEYBOARD
  9AE4  AND A LINE INDEX OF ZERO
  9AE6  EXIT THE BI >>9AEB

  9AE8  RESTORE CALLER'S REGISTERS <9F6C>
  9AEB  AND EXIT BI BY INSTALLING INTERCEPTS >>9A8D

9AEE *********** ERROR HANDLER ***************************************

  9AEE  ERROR=3, "NO DEVICE CONNECTED"
  9AFØ  MAIN ENTRY: STORE ERROR CODE (BEØF)
  9AF3  AND IN APPLESOFT ONERR
  9AF5  CHECK BI STATE (BE42)
  9AF8  MEMORIZE WHETHER IT'S IMMEDIATE MODE
  9AFD  SET A HIGH FILE LEVEL FOR NON-EXEC FILES (BF94)
  9B02  NO ACTIVE READ/WRITE FILES OR PREFIX READ (BE44)
  9BØB  CLOSE ALL OPEN FILES AT OR ABOVE (BEDE)
  9BØE  FILE LEVEL = $ØF
  9B1Ø  MLI: CLOSE (ALL) <BE7Ø>
  9B13  ERROR? >>9B27
  9B15  WRITE ANY DATA I HAVE BUFFERED <AØØØ>
  9B18  ERROR? >>9B27
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9B1A
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  9B1A  PUT FILE LEVEL BACK TO ZERO
  9B22  NOW FLUSH ALL OPEN FILES
  9B24  MLI: FLUSH (ALL) <BE70>
  9B27  ---
  9B28  ASSUME MODE WILL BE 4 (DEFERRED)
  9B2A  MEMORIZE WHETHER BASIC ONERR ACTIVE
  9B2C  DEFERRED MODE CURRENTLY? >>9B30
  9B2E  NO, STILL IMMEDIATE MODE (MODE=0)
  9B30  ---
  9B31  SET MODE AS DEFINED ABOVE <9F76>
  9B34  RESTORE BI'S CSWL/KSWL INTERCEPTS <9AA3>
  9B37  GET ERROR CODE (BE0F)
  9B3B  BASIC ONERR ACTIVE? THEN GO HANDLE IT >>9B4D
  9B3E  NO, JUST PRINT ERROR MESSAGE <BE0C>
  9B41  CLOSE EXEC FILE IF ONE IS OPEN <B2FB>
  9B45  DEFERRED MODE? >>9B53
  9B47  IMMED. MODE, PRINT RETURN AND... <9FAB>
  9B4A  WARMSTART APPLESOFT  >>D43F

  9B4D  RESTORE STACK FOR BASIC
  9B52  PASS ERROR CODE TO BASIC
  9B53  ---
  9B55  JUMP INTO APPLESOFT ERROR HANDLER >>D865

9B58 *********** RETURN TO IMMED. MODE ********************************

  9B58  CLEAR APPLESOFT ERRNUM
  9B5C  WILL LOOK FOR "#" FROM APPLESOFT
  9B61  SET NORMAL VIDEO IN APPLESOFT <F273>
  9B64  RESTORE TRUE CSWL/KSWL <9A00>
  9B67  TRY TO WRITE BUFFERED DATA <9FF4>
  9B6A  RESET MODE/SET UP BI'S INTERCEPTS <9A17>
  9B6D  RESTORE REGISTERS <9F6C>
  9B70  GO TO PROCESS IMMED. INPUT REQUEST >>9ABA

9B73 *********** INPUT INTERCEPT: MODE=4 OR 8 ************************

  9B73  SAVE REGISTERS <9F62>
  9B76  PREFIX INPUT ACTIVE? (BE46)
  9B79  NO >>9B7E
  9B7B  YES, GO DO SPECIAL HANDLING >>9D67
  9B7E  ELSE, IS READ FILE ACTIVE? (BE44)
  9B81  NO >>9B86
  9B83  YES, GO DO SPECIAL HANDLING FOR THAT >>9C16
  9B86  ELSE, IS EXEC FILE ACTIVE? (BE43)
  9B89  NO >>9BAF
  9B8B  YES, GET PROMPT CHARACTER
  9B8D  IT BETTER NOT BE A "]"
  9B8F  IT IS, RETURN TO IMMEDIATE MODE >>9B58
  9B91  ELSE, SET TRUE CSWL/KSWL <9A00>
  9B94  AND PASS CALLER'S AREG TO REMOVE CURSOR (BE3E)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9B97
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  9B97  RESTORE Y-REGISTER (BE40)
  9B9A  REMOVE CURSOR AND GET A KEYPRESS <FD10>
  9B9D  BACKSPACE?
  9B9F  NO, EXIT BI >>9BAC
  9BA1  YES, CHECK PROMPT
  9BA3  IF ITS A ">"...
  9BA5  THEN EXIT WITH THE BACKSPACE >>9BAA
  9BA8  ELSE, IF AT START OF LINE, REPROMPT >>9B94
  9BAA  MIDDLE OF LINE, RETURN A BACKSPACE
  9BAC  EXIT BI TO CALLER >>9A8D

9BAF *********** READ EXEC FILE ***************************************

  9BAF  REMOVE CURSOR FROM SCREEN
  9BB1  CHECK PROMPT CHARACTER
  9BB3  IF ITS A ">"...
  9BB5  DO THINGS DIFFERENTLY >>9BF2
  9BB7  CHECK KEYBOARD (C000)
  9BBA  NO KEY READY? >>9BCD
  9BBC  GOT A KEY, IS IT CONTROL-C?
  9BBE  NO, IGNORE IT  >>9BCD
  9BC0  YES, CLOSE EXEC FILE <B2FB>
  9BC3  IMMEDIATE MODE? (BE42)
  9BC6  NO >>9C01
  9BC8  YES, CLEAR KEYBOARD STROBE (C010)
  9BCB  AND GO START NEW LINE >>9C01
  9BCD  SET UP FOR EXEC LINE READ <9D8A>
  9BD0  READ A LINE TO $200 <9C6C>
  9BD3  ERROR? >>9BFA
  9BD5  SAVE REGISTERS <9F62>
  9BD8  HOP INTO LOOP >>9BDE
  9BDA  ---
  9BDB  BACKSCANNING $200 BUFFER (0200)
  9BDE  FORCING THE MSB ON
  9BE6  RESTORE TRUE CSWL/KSWL <9A00>
  9BE9  GO PROCESS COMMAND LINE <9AD5>
  9BEC  CHECK COMMAND NUMBER (BE53)
  9BEF  IMMEDIATE EXIT? IF NOT, GET NEXT LINE >>9BCD
  9BF1  RETURN

        ******** HANDLE EXEC PROMPT > ***********

  9BF2  GET SET TO READ EXEC LINE <9D8A>
  9BF5  READ SINGLE CHARACTER PER CALL <9C48>
  9BF8  NO ERRORS, EXIT TO CALLER NOW >>9BF1

        ******** EXEC ERROR RECOVERY ************
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9BFA
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  9BFA  CLOSE EXEC FILE <B245>
  9BFD  WAS ERROR "END OF DATA"?
  9BFF  NO, REAL ERROR THEN >>9C13
  9C01  ELSE, OK -- JUST STOP EXECING
  9C03  GET CURSOR HORIZONTAL POSITION
  9C05  IF IN MID LINE, PASS SCREEN CHAR BACK >>9C0E
  9C07  ELSE, CHANGE PROMPT TO "]"
  9C0B  AND RETURN WITH A BACKSPACE
  9C0D  RETURN
  9C0E  GET SCREEN CHARACTER UNDER CURSOR
  9C10  AND EXIT THRU KSWL TO GET REAL KEYPRESS >>0038
  9C13  REAL ERROR, GO TO BI'S MAIN ERROR HANDLER >>9AF0

9C16 ********** INPUT FILE ACTIVE **********************************

  9C16  GET PROMPT
  9C18  IF ITS A "]"...
  9C1C  THEN RESET TO IMMEDIATE MODE >>9B58
  9C1F  ELSE, REMOVE CURSOR FROM SCREEN (BE3E)
  9C24  CHECK KEYBOARD (C000)
  9C27  NO KEYPRESS? >>9C31
  9C29  GOT A KEY, IS IT CONTROL-C?
  9C2B  NO, IGNORE IT >>9C31
  9C2D  CLEAR STROBE AND EXIT TO CALLER (C010)
  9C30  RETURN

  9C31  GET PROMPT AGAIN
  9C33  IS THIS A DIRECTORY FILE? (BE47)
  9C36  YES >>9C95
  9C38  NO, IS PROMPT = ">"?
  9C3A  YES, READ A SINGLE BYTE AT A TIME >>9C42
  9C3C  ELSE, READ ENTIRE LINE <9C67>
  9C3F  ERROR? >>9C13
  9C41  RETURN

  9C42  READ SINGLE BYTE FROM INPUT FILE <9C48>
  9C45  ERROR? >>9C13
  9C47  RETURN

9C48 ********** READ NEXT BYTE OF FILE ******************************

  9C48  SAVE CURRENT READ/WRITE COUNT (BED9)
  9C4B  IN L KEYWORD VALUE (BE5F)
  9C50  SET UP TO READ ONE BYTE (BED9)
  9C55  MLI: READ <BE70>
  9C58  ERROR? >>9C66
  9C5A  PUT COUNT BACK TO MAXIMUM AGAIN (BE5F)
  9C60  GET FIRST CHARACTER ON $200 LINE (BED7)
  9C63  AND RETURN THAT TO CALLER (0200)
  9C66  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9C66
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

9C67 ********** READ NEXT LINE OF FILE ******************************

  9C67  REMOVE CURSOR FROM SCREEN (BE3E)
  9C6C  ---
  9C6E  MLI: READ <BE70>
  9C71  ERROR? >>9C66
  9C73  GET LENGTH ACTUALLY TRANSMITTED (BEDB)
  9C76  NOTHING? >>9C8E
  9C79  GOT SOMETHING, FIND END OF DATA (BED7)
  9C7D  FETCH LAST BYTE OF LINE (01FF)
  9C82  IS IT A RETURN CHARACTER?
  9C84  NO, LEAVE LINE ALONE >>9C8E
  9C86  YES, WAS L KEYWORD GIVEN? (BE57)
  9C8B  YES, LEAVE IT BE >>9C8E
  9C8D  ELSE, CHOP OFF THE RETURN ITSELF
  9C8E  AND EXIT WITH A RETURN
  9C90  RESTORING Y REG AS YOU GO (BE40)
  9C94  RETURN

9C95 ********** READING DIR FILE **********************************

  9C95  ">" PROMPT?
  9C97  YES, EXIT RIGHT NOW >>9C8E
  9C99  ELSE, REMOVE CURSOR FROM SCREEN (BE3E)
  9C9E  SET 80 COLUMNS
  9CA5  MLI: GET MARK <BE70>
  9CA8  ERROR? >>9D1F
  9CAA  ARE WE AT BEGINNING OF THIS FILE? (BEC8)
  9CB0  NO, CONTINUE >>9CDF
  9CB2  YES, CAT FLAG = 2
  9CB7  READ DIRECTORY HEADER <B15D>
  9CBA  ERROR? >>9D1F
  9CBC  REF NUM TIMES 32 (BED6)
  9CC7  SET THE L VALUE OF THIS DIR FILE IN (BCFF)
  9CCA  THE OPEN FILE LIST TO THE ENTRY LENGTH (BCB8)
  9CCD  AND THE NUMBER OF ENTRIES PER BLOCK (BD00)

          ******** FORMAT DIRECTORY NAME **********

  9CD0  GO FORMAT NAME OF DIRECTORY <B0B8>
  9CD3  STORE THE LENGTH OF LINE AT $200
  9CD8  PUT A RETURN CHAR AT END OF LINE
  9CDD  AND EXIT TO CALLER
  9CDE  RETURN

  9CDF  GET CAT FLAG (BE4F)
  9CE2  IF ZERO, GO PROCESS INDIVIDUAL ENTRIES >>9D22
  9CE4  IF MINUS, GO DO SUMMARY LINE OR EXIT >>9CF9
  9CE6  POSITIVE, ASSUME NULL LINE WANTED
  9CE8  DROP CAT FLAG BY ONE (BE4F)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9CEB
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

 9CEB  IF ZERO, JUST GO PRINT A BLANK LINE >>9CD3

         ******** FORMAT TITLE LINE **************

 9CED  ELSE, BLANK OUT $200 AND <A66C>
 9CF2  UNPACK "NAME TYPE BLOCKS ETC... <9FB0>

 9CF5  LINE LENGTH IS 80
 9CF7  GO RETURN IT TO CALLER >>9CD3

         ******** FORMAT SUMMARY LINE ************

 9CF9  DO SUMMARY LINE?
 9CFB  NO, JUST EXIT (ALL DONE) >>9D1C
 9CFD  YES, DROP CAT FLAG SO EXIT NEXT TIME (BE4F)
 9D02  CLEAR READ/WRITE COUNT (BED9)
 9D0A  ML1: READ <BE70>
 9D0D  FORMAT BLOCKS FREE AND INUSE SUMMARY LINE <B0E7>
 9D11  GET REF NUM  (BED6)
 9D14  AND COPY TO GET/SET LIST (BEC7)
 9D18  NO ERRORS, EXIT >>9CF5
 9D1A  ERROR, JUMP TO BI ERROR EXIT >>9D1F
 9D1C  "END OF DATA" ERROR
 9D1F  GO TO BI ERROR EXIT >>9AF0

         ******** FORMAT FILE/DIR ENTRIES ********

 9D22  SET DIR ENTRY NUM COUNTER TO -1
 9D27  GET REF NUM (BED6)
 9D2A  *32
 9D2F  USE AS INDEX TO GET ENTRY LENGTH (BCFF)
 9D35  AND ENTRIES PER BLOCK FROM OPEN FILE LIST (BD00)
 9D3B  POSITION ON EVEN BLOCK BOUNDARY (BEC9)
 9D41  AND GET SECTOR OFFSET (BEC8)
 9D45  SKIP FILE/DIR ENTRIES UNTIL POSITIONED TO (BCBB)
 9D48  CURRENT POSITION IN THIS BLOCK (BCB7)
 9D50  READ NEXT DIR ENTRY FROM FILE <B1D1>
 9D53  NO ERROR? >>9D61
 9D55  ERROR, IF RANGE ERROR...
 9D57  NO, TRUE ERROR >>9D1F
 9D59  RANGE ERROR, READY FOR SUMMARY LINE NEXT (BE4F)
 9D5E  RETURN A BLANK LINE THIS TIME >>9CD3

 9D61  FORMAT FILE/DIR ENTRY INTO $201 <A4C4>
 9D64  AND RETURN IT TO CALLER >>9CF5
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9D67
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

9D67 ********** PREFIX INPUT ACTIVE *********************************

 9D67  PROMPT = "]"?
 9D69  NO, ALL IS WELL >>9D6E
 9D6B  YES, RETURN TO IMMEDIATE MODE NOW >>9B58
 9D6E  REMOVE CURSOR FROM SCREEN (BE3E)
 9D75  PREFIX NO LONGER ACTIVE AFTER THIS (BE46)
 9D7B  COPY PATHNAME BUFFER (PREFIX) (BCBC)
 9D7E  TO $200 (01FF)
 9D84  RETURN WITH IT TO BASIC (BCBC)
 9D89  RETURN

9D8A ********** SETUP TO READ LINE FROM EXEC ************************

 9D8A  SET READ REF NUM FOR EXEC FILE (BCA3)
 9D90  READ TO $200
 9D95  FOR $EF BYTES OF LENGTH
 9D9A  (OR UNTIL A RETURN CHAR)
 9DA2  RETURN

9DA3 ********** OUTPUT INTERCEPT: MODE = C **************************
         (LOOK FOR CONTROL-D)

 9DA3  SAVE REGISTERS <9F62>
 9DA6  PRINTING A CONTROL-D?
 9DA8  NO >>9DC1
 9DAA  YES, WRITE OUT ANY BUFFERED DATA <9FF4>
 9DAD  NOTHING IN COMMAND LINE (BE4B)
 9DB0  READ FILE INACTIVE (BE44)
 9DB3  WRITE FILE INACTIVE (BE45)
 9DB6  PREFIX READ INACTIVE (BE46)
 9DBB  SET MODE = 8 FROM NOW ON <9F76>
 9DBE  RESTORE REGS AND EXIT >>9F6C

 9DC1  GOT A CONTROL-D...
 9DC3  SET MODE = 4 FROM NOW ON <9F76>
 9DC6  RESTORE REGISTERS <9F6C>
 9DC9  OUTPUT CHARACTER AND EXIT >>B7F1

9DCC ********** OUTPUT INTERCEPT: MODE = 8 **************************
         (ASSEMBLE COMMAND LINE)

 9DCC  SAVE REGISTERS <9F62>
 9DD2  SAVE CHAR IN COMMAND LINE (0200)
 9DD5  WAS IT A RETURN?
 9DD7  YES, READY TO ROLL >>9DE7
 9DD9  NO, BUMP CHARACTER COUNTER (BE4B)
 9DDC  AND EXIT TO CALLER >>9DE3
 9DDE  OOPS! LINE TOO LONG
 9DE0  "SYNTAX ERROR" >>9AF0
 9DE3  ELSE, RESTORE X REG AND EXIT (BE3F)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9DE6
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

  9DE6  RETURN

  9DE7  ---
  9DE9  NULL LINE? >>9DF6
  9DEB  NO, PUT BACK TRUE CSWL/KSWL <9AØØ>
  9DEE  SYNTAX SCAN CMD LINE <A677>
  9DF1  ERROR? >>9DEØ
  9DF3  NO, PUT BACK BI'S INTERCEPTS <9A8D>
  9DF6  ---
  9DF8  MODE = 4 NOW <9F76>
  9DFB  RESTORE REGS AND EXIT >>9F6C

9DFE *********** WRITE BUFFERED CHARACTER ****************************

  9DFE  SAVE Y REG (BE4Ø)
  9EØ1  CHECK PROMPT
  9EØ3  CHECK TO SEE IF WE ARE IN "IF", >>9E11
  9EØ6  "PRINT", "LIST", OR "CALL" STATEMENTS >>9E11
  9EØ9  OF AN APPLESOFT PROGRAM >>9E11
  9EØB  IF NOT, EXIT TO CALLER... (BE4Ø)
  9EØE  WITH CHARACTER ECHOED TO SCREEN >>9A74

  9E11  GET INDEX TO TEMPORARILY BUFFERED CHARS (BE4A)
  9E16  STORE INTO BUFFER JUST ABOVE HIMEM
  9E1B  BUMP INDEX (BE4A)
  9E1E  OK >>9E2B
  9E2Ø  BUFFER FULL, SAVE REGISTERS <9F62>
  9E23  WRITE BUFFER OUT TO DISK <9FEE>
  9E26  ERROR? >>9DEØ
  9E28  RESTORE REGISTERS <9F6C>
  9E2B  AND EXIT ANYWAY

9E2C *********** OUTPUT INTERCEPT: MODE = 4 **************************
          (INITIAL ENTRY FOR A RUNNING PROGRAM)
          (FLUSH OUT NON COMMAND LINES)

  9E2C  PRINTING A "#"? (9F61)
  9E2F  NO >>9E49
  9E31  YES, SAVE X REGISTER (BE3F)
  9E35  RETURN ADDR IS IN APPLESOFT... (Ø1Ø3)
  9E38  TRACE ROUTINE...
  9E3C  AT $D812? (Ø1Ø4)
  9E41  YES >>9EB6
  9E43  NO, RESTORE REGISTERS (9F61)
  9E49  IS WRITE FILE ACTIVE? (BE45)
  9E4C  NOPE >>9E6C
  9E4E  YES, PRINTING A "]"?
  9E5Ø  NO >>9E56
  9E52  YES, SAME AS PROMPT CHARACTER?
  9E54  YES >>9E86
  9E56  NO, PRINTING A RETURN CHAR?
```

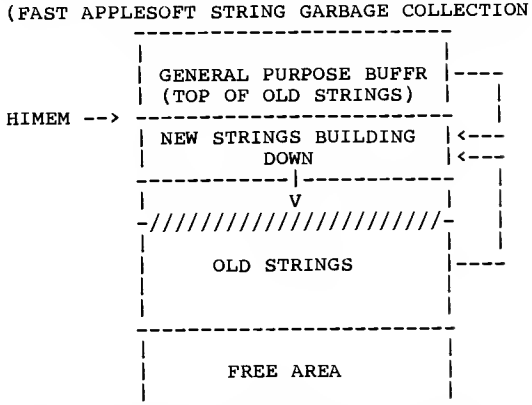
```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9E58
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

  9E58  NO >>9DFE
  9E5A  YES, GET PROMPT
  9E6Ø  DOES IT INDICATE RECURSION? >>9DFE
  9E62  YES, WRITE BUFFER OUT <9FF4>
  9E65  OUTPUT FILE INACTIVE NOW (BE45)
  9E6A  EXIT WITH RETURN CHAR >>9E9F

  9E6C  ---
  9E6D  INPUT FILE ACTIVE? (BE44)
  9E73  NO >>9E7D
  9E75  YES, CHECK PROMPT
  9E77  OR IN $Ø4
  9E79  CONTROL-D?
  9E7B  YES >>9EA2
  9E7D  ---
  9E7E  NO, HOW BOUT "]"?
  9E8Ø  NO, EXIT WITH ECHO THEN >>9E9F
  9E82  YES, IS THIS THE PROMPT CHAR?
  9E84  NO, EXIT WITH ECHO >>9E9F
  9E86  YES, SAVE REGISTERS <9F62>
  9E89  CHECK OPEN FILE COUNT (BE4D)
  9E8C  NONE OPEN? >>9E9C
  9E8E  SOME OPEN, WRITE BUFFER OUT <9FF4>
  9E91  INDICATE WRITE FILE INACTIVE NOW (BE45)
  9E94  SET TRUE CSWL/KSWL <9AØØ>
  9E99  PRINT "FILE(S) STILL OPEN" <BEØC>
  9E9C  RESTORE REGS <9F6C>
  9E9F  AND ECHO EXIT >>9A74

  9EA2  ---
  9EA3  CHAR IS A RETURN?
  9EA5  NO >>9EAA
  9EA7  YES, SAME AS LAST CHAR OUTPUT? (BE4C)
  9EAA  (SAVE IT FOR THIS TEST NEXT TIME) (BE4C)
  9EAD  NOT SAME, NO PROBLEM THEN >>9EB1
  9EAF  SAME, MARK PROMPT FOR RECURSION
  9EB1  RETURN

9EB2 *********** APPLESOFT TRACE INTERCEPT ***************************
          (CONTROL PASSES HERE FOR EVERY STATEMENT)
          (EXECUTED WHILE PRODOS IS ACTIVE)

  9EB2  BUMP APPLESOFT LINE POINTER
  9EB6  ---
  9EBA  MARK PROMPT FOR RECURSION
  9EBC  JUST IN CASE WE DIE IN HERE
  9EBE  RESTORE APPLESOFT'S STACK
  9EC1  DOES BI KNOW WE ARE TRACING? (BE41)
  9EC4  YES, REAL LIVE TRACE THEN >>9F39
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9EC4
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 9EC6  ELSE, PICK UP NEXT TOKEN ON LINE
 9ECA  IS IT A TOKEN? >>9EF1
 9ECC  OR END OF LINE? >>9EEE
 9ECE  NEITHER, DECREMENT STRING SPACE CTR (BE49)
 9ED1  OK >>9EEC
 9ED3  COMPUTE SIZE OF FREESPACE IN PAGES
 9ED7  AT LEAST 3 PAGES AVAILABLE?
 9ED9  YES >>9EE5
 9EDB  NO, WRITE BUFFERED DATA <9FF4>
 9EDE  AND THEN GARBAGE COLLECT <A044>
 9EE3  COMPUTE FREE SPACE NOW
 9EE5  AND SAVE IN STRING SPACE CTR  (BE49)
 9EEA  GET NEXT TOKEN
 9EEC  ---
 9EEE  JUMP BACK INTO APPLESOFT TO EXECUTE IT >>D820
 9EF1  STORE TOKEN IN PROMPT
 9EF4  LOOK UP TOKEN IN BI'S TOKEN TABLE (B799)
 9EF7  ITS NOT ONE BI IS INTERESTED IN >>9EEE
 9EF9  IT IS INTERESTING, CHANGE BRANCH (9EFD)
 9EFC  AND JUMP TO ONE OF THE FOLLOWING: >>9EFE

 9EFE  IF OR PRINT: PROMPT = Ø
 9F00  CLEAR OUT LAST CHAR SAVEAREA (BE4C)
 9F03  GO TO MODE = C NEXT TIME THRU (B803)
 9F06  (BEGIN LOOKING FOR COMMANDS) (BE38)
 9F0F  NOW GO PROCESS THE IF OR PRINT >>9F2E

 9F11  LIST: PROMPT = 1
 9F13  (DON'T LOOK FOR COMMANDS NOW)
 9F15  GO DO IT >>9F2E

 9F17  CALL: PROMPT = 2
 9F19  (DON'T LOOK FOR COMMANDS NOW)
 9F1B  GO DO IT >>9F2E

 9F1D  LET: DECREMENT STRING CTR
 9F1E  AND GO BACK FOR NEXT TOKEN >>9ECE

 9F21  TRACE: TURN TRACE ON (BE41)
 9F24  THEN CONTINUE BELOW >>9F2A

 9F26  NOTRACE: DROP INTO BACKGROUND TRACE (BE41)
 9F29  CHANGE TOKEN TO "TRACE"
 9F2A  FORCE ON APPLESOFT TRACE
 9F2E  ---
 9F2F  GO BACK TO APPLESOFT TO PERFORM IT >>D820
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9F2F
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 9F32  RESUME: CLEAR ONERR CODE
 9F37  GO TO APPLESOFT TO PROCESS IT >>9EEC

        ******** REAL TRACE ACTIVE **************

 9F39  RESTORE TRUE CSWL/KSWL <9A00>
 9F3E  PRINT "#" <FDED>
 9F45  USE APPLESOFT TO PRINT CURRENT LINE NO. <ED24>
 9F4A  PRINT A BLANK SPACE <FDED>
 9F4D  PUT BI'S CSWL/KSWL INTERCEPTS BACK <9A8D>
 9F51  THEN GO BACK AND HANDLE AS USUAL >>9EC6

 9F54  LOOKING FOR A LOWER CASE "c"
 9F58  LOOKING FOR A "#"
 9F5A  STORE CHAR TO SEARCH FOR (9F61)
 9F5E  BRANCH BACK INTO APPLESOFT >>9EEC
 9F60  BREAK IF Y IS ZERO!!!

 9F61  "#" CHARACTER (ASOFT TRACE CHAR)

9F62 *********** SAVE CALLER'S REGISTERS ****************************

 9F62  SAVE A,X AND Y REGS (BE3E)
 9F6B  RETURN

9F6C *********** RESTORE CALLERS REGISTERS **************************

 9F6C  RESTORE A,X AND Y REGS (BE3E)
 9F75  RETURN

9F76 *********** SET MODE AND CSWL/KSWL *****************************

 9F76  STORE "STATE" MODE FROM X REGISTER (BE42)
 9F7B  COPY PROPER CSWL/KSWL VALUES TO REDIRECT... (B7F7)
 9F7E  VECTOR DEPENDING ON CURRENT MODE (BE38)
 9F87  RETURN

9F88 *********** PRINTERR: PRINT ERROR MSG ***************************

 9F88  ---
 9F89  GET INDEX INTO PACKED MESSAGE TEXTS (BA13)
 9F8C  UNPACK MESSAGE INTO $201 <9FB0>
 9F92  SAVE THE LENGTH (BCB6)
 9F95  SKIP A LINE <9FAB>
 9F9A  PRINT A BELL <9FAD>
 9F9D  ---
 9F9F  PRINT CONTENTS OF $201 MSG BUFFER (0201)
 9FAB  PRINT A RETURN CHARACTER
 9FAD  AND EXIT >>FDED
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9FAD
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

9FB0 *********** UNPACK ERROR MESSAGE *********************************

  9FB0  NOTHING IN BUFFER AT FIRST
  9FB6  GET A NIBBLE FROM PACKED MSG  <9FD2>
  9FB9  NON-ZERO, COMMON CHARACTER >>9FC0
  9FBB  IF ZERO, GET NEXT NIBBLE <9FD2>
  9FBE  AND CONVERT TO UNCOMMON CHAR INDEX
  9FC0  ---
  9FC1  GET THE LETTER THIS NIBBLE REPRESENTS (BA28)
  9FC4  ZERO? THEN END OF MESSAGE >>9FD1
  9FC6  GET INDEX INTO OUTPUT BUFFER (BE4B)
  9FC9  AND STORE THE CHARACTER THERE (0201)
  9FCC  BUMP INDEX (BE4B)
  9FCF  AND CONTINUE >>9FB6
  9FD1  RETURN

9FD2 *********** UNPACK MESSAGE BYTE *********************************

  9FD2  GET NEXT MSG BYTE (BA48)
  9FD5  WORKING ON SECOND NIBBLE? >>9FE9
  9FD7  NO, TAB INDICATOR? >>9FDF
  9FD9  NO, ISOLATE HIGH NIBBLE
  9FDD  NEXT TIME GET LOW NIBBLE
  9FDE  RETURN

  9FDF  ---
  9FE0  GET TAB POSITION (BA48)
  9FE3  AND BUMP OUTPUT PTR ACCORDINGLY (BE4B)
  9FE7  THEN GO BACK FOR NEXT NIBBLE >>9FD2

  9FE9  BUMP BYTE PTR FOR NEXT TIME
  9FEA  ISOLATE LOW NIBBLE
  9FEC  NEXT TIME GET HIGH NIBBLE
  9FED  RETURN

9FEE *********** WRITE ONE BUFFERED BYTE ****************************

  9FEE  SET UP COUNT OF 0001
  9FF2  AND JUMP INTO ROUTINE BELOW >>A007

9FF4 *********** WRITE BUFFERED DATA/TEST ERROR **********************

  9FF4  WRITE BUFFERED DATA <A000>
  9FF7  OK? THEN EXIT >>A01C
  9FFA  ERROR, POP OUT OF THIS SUBROUTINE
  9FFD  AND GO TO ERROR HANDLER >>9AF0
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: 9FFD
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A000 *********** WRITE ALL BUFFERED DATA ******************************

  A000  ---
  A002  GET BUFFERED DATA COUNT (BE4A)
  A005  NONE BUFFERED? >>A01B
  A007  STORE BUFFERED DATA COUNT IN RW PARMS (BED9)
  A00F  MLI: WRITE  <BE70>
  A015  NOTHING BUFFERED NOW, COUNT=0 (BE4A)
  A019  ERROR? >>A01C
  A01B  NO, EXIT
  A01C  RETURN

A01D *********** SPECIAL GARBAGE COLLECT ******************************
          (PULL OUT STRING CONSTANTS ALSO)

  A01D  DO GARBAGE COLLECTION NORMALLY FIRST <A044>
  A020  ERROR? >>A043
  A024  START OF STRING AREA = PROGRAM START PTR (BC84)
  A02C  USE GENERAL PURPOSE BUFFER (ABOVE HIMEM)
  A02E  FOR A GARBAGE COLLECT WORKAREA (BC7D)
  A033  IT IS 3+1 PAGES IN LENGTH (BC7E)
  A038  END OF STRING AREA IS AT END OF FREEAREA (BC86)
  A040  GO COLLECT CONSTANT STRINGS NOW <A085>
  A043  THEN EXIT

A044 *********** "FRE" COMMAND ***************************************
          (FAST APPLESOFT STRING GARBAGE COLLECTION)
```




```
TOP PART OF OLD STRINGS IS SAVED IN THE
GENERAL PURPOSE BUFFER OR IN THE FREE
AREA (WHICHEVER IS LARGER) AND A NEW
COPY OF THE STRINGS IS BUILT JUST BELOW
HIMEM.
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A044
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

 A044  STRING AREA START IS ON PAGE BOUNDARY
 A04B  ASSUME 4 PAGE WORKAREA (BC7E)
 A050  IN GENERAL PURPOSE BUFFER ABOVE HIMEM (BC7D)
 A055  STRING START PTR IS START OF STRING AREA (BC84)
 A059  COMPUTE NUMBER OF FREE PAGES
 A05B  AT LEAST 7?
 A05D  IF NOT, USE G.P. WORKAREA INSTEAD >>A079
 A05F  DON'T USE ALL OF FREE AREA (LEAVE $300)
 A061  NEW WORKAREA SIZE IS FREE AREA SIZE-$300 (BC7E)
 A066  SET PTR TO WORKAREA AT FIRST FREE PAGE
 A06D  COMPUTE NUMBER OF STRING PAGES
 A071  USE SMALLER OF STRING PAGES OR WORKAREA SIZE (BC7E)
 A076  AS NEW WORKAREA SIZE (BC7E)
 A079  END OF STRING AREA IS HIMEM
 A085  RECORD WHETHER LAST PAGE IS PARTIAL
 A089  STRING START MSB IS HIMEM INITIALLY (BC86)
 A08E  ADJUST LORANGE AND HIRANGE MSB'S
 A090  FOR PARTIAL PAGES AT EITHER END, (BC7F)
 A093  SETTING THEM AT HIMEM FOR NOW.
 A09C  SET UP ARRAY END MSB +1 FOR COMPARES (BC82)
 A09F  $3E/$3F --> FIRST VARIABLE (LESS 7 BYTES)
 A0A1  (EACH VARIABLE IS 7 BYTES)
 A0AB  SET UP ARRAY START LSB FOR COMPARES
 A0B0  GET LORANGE VALUE (BC7F)
 A0B3  PRIOR TO STRING AREA? (BC84)
 A0B6  YES, THEN DONE! >>A0F6
 A0B8  ELSE, DROP LORANGE BY WORKAREA SIZE (BC7E)
 A0BB  AND SAVE THIS VALUE (BC7C)
 A0BE  NOW DROP IT ALSO BY THE DISTANCE BETWEEN
 A0C0  ...THE OLD LORANGE AND THE STRING START PTR (BC7F)
 A0CA  USE THE LOWER OF THE TWO VALUES (BC7C)
 A0CF  TO PRODUCE THE MAXIMUM SIZED RANGE (BC7C)
 A0D2  IS THIS BELOW THE BOTTOM OF THE STRINGS? (BC84)
 A0D5  NO  >>A0DC
 A0D7  YES, USE THE BOTTOM POINTER INSTEAD (BC84)
 A0DA  (ADJUSTING FOR PARTIAL PAGE)
 A0DC  STORE FINAL LORANGE VALUE (BC7F)
 A0DF  COPY SOME PAGES BELOW HIRANGE TO WORKAREA <A195>
 A0E2  (TO MAKE ROOM FOR NEW STRINGS)
 A0E4  COLLECT SIMPLE STRING VARS FOR THIS RANGE <A0F7>
 A0E7  ERROR? >>A0F4
 A0E9  THEN COLLECT STRING ARRAYS <A12D>
 A0EC  NEW HIRANGE = OLD LORANGE (BC7F)
 A0F2  CONTINUE LOOPING >>A09F

 A0F4  IF ERROR, "RAM TOO LARGE"
 A0F6  EXIT TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A0F6
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

A0F7 ********** COLLECT SIMPLE STRINGS ******************************

 A0F7  ---
 A0F8  ADD 7 BYTES TO $3E/$3F PTR FOR NEXT VAR
 A102  PTR AT ARRAYS NOW?
 A108  IF SO, WE ARE DONE >>A12B
 A10A  IS THIS A STRING VARIABLE?
 A111  NO >>A0F7
 A113  MAKE ABSOLUTELY SURE
 A117  GET MSB OF STRING POINTER
 A11B  IS IT WITHIN MY RANGE? (BC7F)
 A11E  NO >>A0F8
 A123  NO >>A0F7
 A125  YES, PULL IT OUT AND TACK IT TO HIMEM <A1B8>
 A128  ALL WENT WELL, GET NEXT VARIABLE >>A0F8
 A12A  IF ERROR, EXIT NOW

 A12B  NORMAL EXIT TO CALLER
 A12C  RETURN

A12D ********** COLLECT STRING ARRAYS ******************************

 A12D  FIND THE NEXT ARRAY <A15C>
 A130  NO MORE? >>A12B
 A132  GOT ONE, GET MSB OF ITS STRING PTR
 A136  WITHIN MY RANGE? (BC7F)
 A139  NO >>A146
 A13E  NO >>A146
 A140  YES, PULL IT OUT AND TACK IT TO HIMEM <A1B8>
 A143  AND CONTINUE WITH NEXT ARRAY ELEMENT >>A147
 A145  ERROR EXIT

 A146  ---
 A147  BUMP POINTER TO NEXT ARRAY MEMBER
 A151  POINTER NOW AT NEXT ARRAY? (BC81)
 A154  NO, DO THIS ELEMENT >>A132
 A158  NO >>A132
 A15A  YES, SET UP TO PROCESS THAT ONE THEN >>A12D

A15C ********** FIND NEXT STRING ARRAY ******************************

 A15C  ---
 A15D  $3E --> ARRAY VARIABLES (BC81)
 A164  AT END OF ARRAY VARS
 A166  NO, CONTINUE >>A16C
 A16A  YES, OUT (CARRY SET, NO MORE ARRAYS) >>A194
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A16A
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  A16C  POINT TO ARRAY FOLLOWING THIS (LSB AND...)
  A176  MSB TO X REGISTER
  A17D  CHECK TYPE OF VARIABLE
  A182  SKIP INTEGER AND REAL ARRAYS >>A15C
  A186  GET NUMBER OF DIMENSIONS
  A188  *2 TO SKIP SIZES
  A189  +5 TO SKIP FIXED STUFF AT BEGINNING
  A18D  POINT TO FIRST ARRAY MEMBER
  A191  READY TO ROLL, $3E POINTS TO IT
  A194  RETURN

A195 *********** COPY PAGES TO WORKAREA *****************************
          TO MAKE ROOM FOR NEW STRINGS BEING MOVED
          TO HIMEM, COPY SOME STRING PAGES FROM OLD
          STRING AREA TO THE WORKAREA TO PROTECT THEM.

  A195  $3A/$3B --> FIRST PAGE TO SAVE (BC7C)
  A19A  $3C/$3D --> WORKAREA (BC7D)
  A1A5  COPY N+1 PAGES (SIZE OF WORKAREA) (BC7E)
  A1A9  ---
  A1B7  EXIT WHEN FINISHED

A1B8 *********** PULL STRING OUT ************************************
          TACK STRING JUST UNDER HIMEM AT CURRENT
          STRING START POINTER.

  A1B8  IS STRING BELOW SAVED AREA? (BC7C)
  A1BB  YES, ITS STILL THERE THEN >>A1C4
  A1BD  ELSE, POINT TO SAVED STRING IN WORKAREA (BC7C)
  A1C4  $3A/$3B --> STRING
  A1CF  DROP STRING START PTR BY LEN OF THIS STRING
  A1D4  UPDATE STRING'S LSB IN VARIABLE PTR
  A1D8  FIX UP MSB OF STRING START PTR ALSO
  A1DD  AND OF VARIABLE PTR
  A1E1  IS THIS A NULL LENGTH STRING?
  A1E3  YES, NO MOVE TO DO >>A1EE
  A1E6  ---
  A1E7  ELSE, COPY STRING OUT
  A1EE  ---
  A1EF  OUT OF FREESPACE? (BC82)
  A1F4  RETURN TO CALLER WITH INDICATION

A1F5 *********** ALLOCATE BUFFER ************************************

  A1F5  NEED 4 PAGES
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A1F5
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

          ******** GENERAL PURPOSE ALLOCATE *******

  A1F7  STORE THAT (BB47)
  A1FA  GO GARBAGE COLLECT TO GET SPACE <A044>
  A1FD  ERROR? >>A24A
  A201  HOW MANY FREE PAGES ARE THERE?
  A203  ARE THERE ENOUGH? (BB47)
  A206  IF NOT, "RAM TOO LARGE" MSG
  A208  TOO FEW... >>A24A
  A20A  GOT ENOUGH, $3A-->TOP OF FREESPACE
  A211  AND $3C-->NEW TOP AFTER ALLOCATION
  A21B  COMPUTE LENGTH OF STRINGS FOR COPY
  A229  COPY STRINGS DOWN "N" PAGES IN MEMORY <A35B>
  A22F  SUBTRACT "N" FROM STRING ADDRESS MSB'S (BB47)
  A235  ADJUST ALL POINTERS IN SIMPLE & ARRAY VARS <A39F>
  A23A  OLD HIMEM BECOMES BUFF ADDR HIGH WATER MARK (BB49)
  A241  NEW HIMEM IS "N" PAGES LOWER
  A246  FIND PAGE JUST BEYOND A FILE BUFFER (BC88)
  A249  RETURN
  A24A  ---
  A24B  RETURN

A24C *********** FREE BUFFER ****************************************

  A24C  GARBAGE COLLECT STRINGS <A044>
  A24F  ERROR? >>A299
  A255  PUT HIMEM-$100 INTO $3A/3B
  A259  AND HIMEM+$400 INTO $3C/3D
  A25F  (COPY LSB'S)
  A266  BC92 = LENGTH OF STRINGS (BC92)
  A270  COPY STRINGS UP 4 PAGES <A37F>
  A275  PREPARE TO ADJUST THEM BY $400 (BC87)
  A27B  NEW HIMEM+$400
  A27D  ADJUST ALL STRING ADDRS UP BY $400 <A39F>
  A283  ARE WE FREEING BOTTOM-MOST BUFFER?
  A285  YES, DONE! >>A2B3
  A288  CHECK OPEN FILE COUNT (BE4D)
  A28B  NONE OPEN? (HOW CAN THAT BE?) >>A297
  A28D  WHICH FILE'S BUFFER IS NEXT TO HIMEM?
  A292  SEARCH UNTIL IT IS FOUND... >>A29A
  A297  ---
  A299  RETURN IF NO FILE IS USING THIS BUFFER
  A29A  ---
  A29B  GIVE THAT FILE THE BUFFER PASSED TO US (BEC9)
  A29E  (SURE HOPE THAT FILE WAS FLUSHED!) (BC93)
  A2A9  PASS FILE REF NUM TO MLI (BEC7)
  A2AE  MLI: SET NEW BUFFER <BE70>
  A2B1  ERROR? >>A299
  A2B3  ---
  A2B4  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A2B4
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A2B5 *********** GETBUFR: GET A BUFFER *****************************
         THIS ROUTINE IS CALLED THROUGH AN EXTERNAL
         ENTRY POINT IN THE GLOBAL PAGE.  IT ALLO-
         CATES A FIXED LOCATION BUFFER BETWEEN THE
         BI AND ITS BUFFERS.

  A2B5  ALLOCATE A BUFFER OF ANY SIZE (A=PAGES) <A1F7>
  A2BB  ERROR? >>A300
  A2BD  FIND FIRST PAGE OF BUFFER (BB4A)
  A2C4  GET FILE OPEN COUNT (BE4D)
  A2C7  NONE OPEN? >>A2EA
  A2C9  BUMP BUFFER PAGE PTR BY $400 (BB49)
  A2CD  TO POINT TO PREVIOUSLY ALLOCATED
  A2CF  BUFFER. (BB49)
  A2D2  FIND OPEN FILE WITH THIS BUFFER (BC93)
  A2D7  GOT IT, (BEC9)
  A2DA  SET FILE BUFFER REAL LOW IN MEMORY <A352>
  A2DD  THEN SET IT TO NEW BUFFER LOCATION <A29B>
  A2E0  BELOW ALL OTHERS (BEC9)
  A2E7  DO THIS FOR EACH OPEN FILE...
  A2E8  THEREBY INSERTING A BLANK BUFFER >>A2D2
  A2ED  IS EXEC FILE ACTIVE? (BE43)
  A2F0  NO, DONE >>A2FF
  A2F2  YES,
  A2F4  MOVE EXEC BUFFER DOWN ALSO <A352>
  A2FD  AND BUMP UP ABOVE IT
  A2FF  EXIT TO CALLER
  A300  RETURN

A301 *********** FREEBUFR: FREE BUFFER *****************************
         THIS ROUTINE IS CALLED THROUGH AN EXTERNAL
         ENTRY POINT IN THE GLOBAL PAGE.  IT FREES
         A FIXED LOCATION BUFFER PREVIOUSLY ALLO-
         CATED BY GETBUFR.

  A301  GET COUNT OF OPEN FILES (BE4D)
  A305  INDEX THIS BY 4 PAGES PER FILE
  A306  ADD TO HIMEM MSB
  A308  SAVE THIS AS TOP OF BUFFERS (BB49)
  A30D  THEN SET UP BOTTOM AS HIMEM MSB (BB4A)
  A310  GET OLD ORIGINAL HIMEM (BEFORE ANY BUFFERS) (BEFB)
  A313  SAME AS THIS ONE?
  A315  THEN NOTHING ELSE TO DO >>A350
  A317  ASSUME NO BUFFERS BY REPLACING OLD HIMEM
  A319  ANY EXEC FILE OPEN? (BE43)
  A31C  NO, CONTINUE >>A323
  A31E  YES, MOVE EXEC BUFFER TO OLD HIMEM <A2F2>
  A321  AND GO MOVE HIMEM DOWN BY $400 >>A341
  A323  ELSE, START WITH TOP BUFFER (BB49)
  A326  ANY OPEN FILES? (BE4D)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A329
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A329  IF NOT, WE ARE DONE >>A34D
  A32B  SEARCH FOR OPEN FILE WITH THIS BUFFER (BC93)
  A32E  NOT IT? >>A34A
  A330  GOT IT, GIVE IT NEW HOME AT HIMEM
  A332  AND SET BUFFER LOW <A352>
  A335  THEN TO NEW LOC <A29B>
  A339  DROP TOP BUFFER PTR BY $400 (BB49)
  A341  AND DROP HIMEM BY $400
  A348  AND GO DO NEXT BUFFER >>A323
  A34A  ---
  A34B  (LOOP TO SEARCH FOR OPEN FILES) >>A32B
  A34D  WHEN FINISHED, GARBAGE COLLECT <A044>
  A350  ---
  A351  THEN EXIT NORMALLY TO CALLER

          ******** SET BUFFER BELOW ALL OTHERS ***

  A352  ---
  A353  USE BOTTOM BUFFER PTR (BB4A)
  A356  SET FILE BUFFER <A29B>
  A35A  AND EXIT

A35B *********** COPY BLOCK DOWN IN MEMORY ***************************

  A35B  COPY ALL FULL PAGES DOWN TO THEIR NEW HOME
  A362  COPYING $3A-->$3C
  A369  BUMP BOTH MSB'S
  A36D  DROP PAGE COUNTER (BC93)
  A370  AND CONTINUE >>A362
  A372  NO SHORT LAST PAGE? (BC92)
  A375  THEN EXIT NOW >>A37E
  A377  ELSE, COPY PARTIAL PAGE
  A37E  THEN EXIT

A37F *********** COPY BLOCK UP IN MEMORY *****************************

  A37F  PARTIAL PAGE? (BC92)
  A3B2  NO, JUST COPY FULL PAGES NOW >>A38B
  A384  YES, COPY SHORT PAGE FIRST <A396>
  A387  DROP BOTH MSB'S
  A38B  PAGE COUNT GONE TO ZERO? (BC93)
  A38E  YES, DONE >>A39E
  A390  ELSE, DROP PAGE COUNT (BC93)
  A393  AND GO COPY A FULL PAGE UP >>A384

  A396  ---
  A397  COPY REMAINDER OF PAGE UP (BACKWARDS)
  A39E  RETURN
```

```
BASIC Interpreter (BI) -- VI.I.I -- I8 JUN 84   NEXT OBJECT ADDR: A39E
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A39F ********** ADJUST ALL STRING ADDRS ****************************
         (BC87 HAS ADDITIVE ADJUSTMENT FACTOR)

  A39F  USE LOMEM PAGE AS MSB FOR $3E/3F
  A3A3  GET LOMEM LSB
  A3A5  AND END OF SIMPLE VARS PAGE
  A3A8  JUMP INTO THE LOOP >>A3AF
  A3AA  ---
  A3AB  SKIP ONE SIMPLE VARIABLE
  A3AF  ---
  A3BI  OVERFLOW?  >>A3B5
  A3B3  YES, BUMP MSB
  A3B5  FINISHED WITH SIMPLE VARS?
  A3B9  (CHECK BOTH MSB AND LSB OF PTR)
  A3BB  ---
  A3BC  YES... >>A3D2
  A3BE  NO,
  A3CØ  LOOK AT A SIMPLE VARIABLE
  A3C5  SKIP INTEGER AND REAL VARS >>A3AA
  A3C7  (DOUBLE CHECK MSB)
  A3CB  ITS A STRING, POINT TO ITS LEN/ADDR
  A3CC  ADJUST IT IF NECESSARY <A3F9>
  A3CF  THEN SKIP OVER IT >>A3AA

  A3D2  COPY ARRAYS STARTING LSB
  A3D4  (MSB IS IN X REGISTER NOW) (BC8I)
  A3D7  ---
  A3D8  FIND A STRING ARRAY <A15C>
  A3DB  NO MORE? THEN DONE... >>A4ØC
  A3DD  ---
  A3EØ  ADJUST ITS ADDRESS IF NEED BE <A3F9>
  A3E6  SKIP TO NEXT STRING ELEMENT OF ARRAY
  A3EE  AT END OF THIS ARRAY YET? (BC8I)
  A3FI  NO... >>A3DD
  A3F3  (CHECK MSB ALSO)
  A3F7  YES..., GO GET NEXT ARRAY >>A3D7

A3F9 ********** ADJUST A STRING ADDRESS ****************************

  A3F9  GET STRING LENGTH
  A3FB  IGNORE NULL STRINGS >>A4ØC
  A3FD  POINT TO MSB OF ADDRESS
  A3FF  IS STRING STORED OUTSIDE OF PROGRAM?
  A4Ø3  NO, LEAVE IT ALONE >>A4ØC
  A4Ø5  STORE ABOVE LOMEM, ADD FACTOR TO MSB
  A4ØC  THEN EXIT
```

```
BASIC Interpreter (BI) -- VI.I.I -- I8 JUN 84   NEXT OBJECT ADDR: A4ØC
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A4ØD ********** COMPRESS ALL ASOFT VARS ****************************
         THIS ROUTINE SQUASHES ALL APPLESOFT VARS
         UP AGAINST THE BOTTOM OF THE STRINGS
         HIMEM --> -------------------------
                   |                       |
                   |       STRINGS         |
                   |                       |
                   -------------------------
                   |                       |
                   |       ARRAY VARS      |
                   |                       |
                   -------------------------
                   |                       |
                   |       SIMPLE VARS     |
                   |                       |
                   -------------------------

  A4ØD  GARBAGE COLLECT FIRST <AØID>
  A4IØ  ERROR? >>A47I
  A412  COMPUTE LENGTH OF SIMPLE AND ARRAY VARS
  A4I7  AND SAVE IT (BC89)
  A427  NEXT, COMPUTE LENGTH OF SIMPLE VARS ONLY
  A42B  AND SAVE IT (BC8B)
  A435  SUBTRACT VAR LENGTH FROM STRING START
  A437  TO FIND A PLACE TO PUT THE VARS UNDER (BC92)
  A43A  THE STRINGS (START ON AN EVEN PAGE BOUND)
  A44Ø  $3C/$3D --> PLACE TO PUT VARS
  A447  $3A/$3B --> START OF VARS (ROUNDED TO EVEN
  A449              PAGE ALIGNEMENT)
  A44F  COPY VARS UP AGAINST STRINGS <A37F>
  A454  STORE START OF VARS PTR (BC8E)
  A457  BUMPING PAGE NUMBER BY ONE
  A463  SUBTRACT THIS PTR FROM HIMEM TO COMPUTE (BC9Ø)
  A466  TOTAL LENGTH OF COMBINED VARS/STRINGS
  A468  AND SAVE THIS TOO (BC8D)
  A46B  ALSO, SAVE HIMEM MSB IN CASE THEY ARE MOVED
  A47I  DONE, EXIT

A472 ********** REEXPAND COMPRESSED VARS ****************************
         THIS ROUTINE MOVES SIMPLE AND ARRAY VARS
         BACK DOWN TO LOMEM.
         HIMEM --> -------------------------
                   |                       |
                   |       STRINGS         |
                   |                       |
                   -------------------------
                   |                       |
                   |                       |
                   /     FREE SPACE        /
                   /                       /
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A472
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

                    |                       |
                    |                       |
                    -------------------------
                    |                       |
                    |      ARRAY VARS       |
                    |                       |
                    -------------------------
                    |                       |
                    |      SIMPLE VARS      |
                    |                       |
          LOMEM --> -------------------------

  A472  SAVE LENGTH OF SIMPLE AND ARRAY VARS (BC89)
  A479  ADD THIS TO START OF COMPRESSED VARS PTR
  A47B  TO GIVE START OF STRINGS ($6D/$6E)
  A487  $3C/$3D --> LOMEM (WHERE TO PUT SIMPLE VARS)
  A48E  $6B/$6C --> WHERE TO PUT ARRAY VARS
  A499  $3A/$3B --> START OF COMPRESSED VARS (BC8E)
  A4A3  COPY SIMPLE/ARRAY VARS DOWN TO LOMEM <A35B>
  A4AA  COMPUTE START OF STRINGS BY ADDING VARS
  A4AC  LENGTH TO VARS ORIGIN
  A4B5  DID HIMEM MOVE SINCE VARS WERE COMPRESSED?
  A4BA  NO... >>A4C2
  A4BC  YES, ADJUST BY DIFFERENCE IN HIMEM'S (BC87)
  A4BF  GO ADJUST ALL STRING POINTERS <A39F>
  A4C2  THEN EXIT
  A4C3  RETURN

A4C4 *********** FORMAT CATALOG ENTRY LINE ***************************

  A4C4  PUT OUT A BLANK LINE <A66C>
  A4C7  DOUBLE QUOTE TO $200
  A4CC  GET LENGTH OF NAME (0259)
  A4D2  COPY NAME TO LINE (0259)
  A4DD  ZERO ACCUMULATOR FOR LATER (BCB1)
  A4E0  GET FILE TYPE (0269)
  A4E3  I KNOW OF ONLY 13
  A4E5  ---
  A4E7  LOOK UP FILE TYPE IN TABLE (B989)
  A4EA  FOUND IT? >>A4F7
  A4F0  FILE TYPE NOT IN MY TABLE
  A4F2  PRINT IT IN HEXADECIMAL <A612>
  A4F5  AND CONTINUE BELOW >>A53B
  A4F7  ELSE, FOR KNOWN TYPES
  A4FA  COPY NAME OF TYPE TO THE LINE (B997)
  A505  80 COLUMNS PER LINE? (BCB6)
  A508  YES... >>A553
  A50A  NO,
  A50C  BIN FILE?
  A50E  YES... >>A525
  A510  TXT FILE?
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A512
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A512  NO... >>A53B
  A514  YES, R VALUE GIVEN AS SUBTYPE
  A51F  CONVERT R VALUE TO DECIMAL <A62F>
  A522  SKIP OVER BIN CODE >>A536
  A525  BIN FILE, USE AD VALUE AS SUBTYPE
  A52D  CONVERT IT TO TWO HEX DIGITS <A612>
  A536  ADD AN "=" SIGN
  A53B  COPY MSB OF END OF FILE MARK (0270)
  A549  CONVERT LOW TWO BYTES OF EOF <A62F>
  A550  DO CREATION DATE/TIME <A570>
  A553  ---
  A55B  CONVERT BLOCKS USED <A62F>
  A563  CHECK FOR WRITE ACCESS
  A565  UNLOCKED? >>A56C
  A567  NO, ADD A "*"
  A56C  FALL THRU TO DO LAST MODIFIED DATE/TIME
  A56E  AND THEN EXIT TO CALLER

A570 *********** FORMAT A DATE/TIME ***********************************
          X = OFFSET FROM $259 TO FIELD
          Y = $201 OFFSET TO DATE/TIME VALUE

  A570  ISOLATE YEAR (025A)
  A574  AND STORE IT (BCB5)
  A57B  ISOLATE DAY
  A57D  AND STORE IT (BCB4)
  A581  ISOLATE MONTH
  A587  (MONTH = 0 IS NO GOOD) >>A5A3
  A58B  (MONTH > 12 IS ALSO BAD) >>A5A3
  A58D  STORE MONTH (BCB3)
  A591  MULTIPLY MONTH INDEX BY 3 (BCB3)
  A594  AND SAVE IT INSTEAD (BCB3)
  A59A  (DAY = 0 IS NO GOOD) >>A5A3
  A5A1  (YEAR MUST BE < 99) >>A5B5

  A5A3  OTHERWISE, BAD DATE!
  A5A5  BACK UP 6 CHARACTERS ON LINE
  A5AA  AND PRINT "<NO DATE>" (B9E5)
  A5B4  THEN EXIT RIGHT AWAY

  A5B5  DATE OK, GET HOUR  (025C)
  A5B9  AND MINUTES (025B)
  A5BE  MINUTES > 60?
  A5C0  NO.. >>A5C3
  A5C2   YES, USE ZERO MINUTES
  A5C3  CONVERT MINUTES (LEFT ZERO FILL) <A60A>
  A5C8  THEN PRINT A ":" (0201)
  A5CC  GET HOUR AGAIN
  A5CF  GREATER THAN 24 HOURS?
  A5D1  NOPE >>A5D4
  A5D3  YES, USE ZERO
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A5D4
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  A5D4  1Ø OR MORE HOURS (TWO DIGITS?)
  A5D7  IN ANY CASE, CONVERT HOURS <A62F>
  A5DB  IF TWO DIGITS... >>A5DE
  A5DD  IF ONE, ADJUST LINE PTR
  A5DE  ---
  A5E2  CONVERT YEAR (LEFT ZERO FILL) <A60A>
  A5E6  GET MONTH INDEX (*3) (BCB3)
  A5E9  POINT TO LAST CHARACTER
  A5EC  COPY MONTH NAME FROM TABLE (B9BD)
  A5EF  TO LINE (Ø2Ø1)
  A5F7  BACKWARDS... >>A5EC
  A5FB  PUT A "-" IN (Ø2Ø1)
  A5FE  TWO PLACES (Ø2Ø5)
  A6Ø7  EXIT BY CONVERTING DAY >>A62F

A6ØA *********** CONVERT 2 DIGIT NUMBER ******************************
         (FORCE LEFT ZERO FILL)

  A6ØA  ---
  A6ØB  ADD 1ØØ TO FORCE SIGNIFICANCE IN TENS
  A6ØD  CONVERT IT <A62F>
  A61Ø  IGNORE 1ØØ'S PLACE
  A611  RETURN

A612 *********** CONVERT TO HEX ***************************************

  A612  ---
  A613  ISOLATE LOW NIBBLE
  A615  AND GO CONVERT IT FIRST <A61D>
  A619  NOW ISOLATE HIGH NIBBLE
  A61C  AND FALL THRU TO CONVERT IT ALSO

  A61D  CONVERT NIBBLE TO NUMERIC ASCII
  A61F  >9?
  A621  NO >>A625
  A623  YES, CONVERT $BA-$BF TO $C1-$C6
  A625  AND STORE THE RESULT (Ø2Ø1)
  A628  BUMP LINE INDEX BACK
  A629  PRECEED WITH A $ SIGN
  A62E  RETURN

A62F *********** CONVERT TO DECIMAL ************************************

  A62F  A,X = NUMBER    Y=INDEX TO LAST FIELD DIGIT (BCBØ)
  A632  STORE NUMBER IN ACCUMULATOR (BCAF)
  A635  DIVIDE BY 1Ø <A64D>
  A638  GET DIGIT AND CONVERT IT (BCB2)
  A63D  STORE IN LINE (Ø2Ø1)
  A64Ø  AND DROP LINE INDEX BY ONE
  A641  IS QUOTIENT NOW ZERO? (BCAF)
  A64A  NO, CONTINUE UNTIL IT IS >>A635
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A64C
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  A64C  ELSE, EXIT

        ******** DIVIDE ACCUMULATOR BY 1Ø *******

  A64D  24 BIT SHIFT (3 BYTES)
  A651  CLEAR SUM (BCB2)
  A654  GO ROL ACCUMULATOR LEFT ONE BIT <AAD7>
  A657  ALSO ROL 4TH BYTE OF ACCUM (BCB2)
  A65B  IF MSB > 1Ø... (BCB2)
  A665  THEN ADD ONE TO ACCUMULATIVE SUM (BCAF)
  A668  ---
  A669  SHIFT 24 TIMES >>A654
  A66B  RETURN
  A66C  ---
  A676  RETURN

A677 *********** SYNTAX: PARSE COMMAND LINE ***************************
         (ALSO EXTERNAL ENTRY FOR COMMAND STRINGS)

  A677  INIT COMMAND NUMBER TO -1
  A67E  A BLANK ENDS EACH STRING (BCA9)
  A683  AT MOST 8 CHARACTERS IN A COMMAND  (BCAA)
  A686  PARSE COMMAND ITSELF <AA1B>
  A689  GET FIRST LETTER (BCBD)
  A68C  MUST BE ALPHABETIC
  A68E  IT IS... >>A697
  A69Ø  IT'S NOT, IS IT A "-"?
  A692  YES, OK THEN... >>A697
  A694  ELSE, ITS BAD - SYNTAX ERROR >>A839
  A697  SCAN FOR COMMAND IN TABLES <AAE1>
  A69A  BAD COMMAND? >>A694
  A69C  NO, IMMEDIATE COMMAND MODE? (BE42)
  A69F  NO, DEFERRED... >>A6AC
  A6A1  IMMEDIATE, EXEC ACTIVE? (BE43)
  A6A4  YES, NEVER MIND >>A6AC
  A6A6  ERASE TO END OF LINE <FC9C>
  A6A9  AND GO TO A NEW LINE ON SCREEN <9FAB>
  A6AC  ASSUME NO PARMS AT ALL
  A6B4  NO PATH NAME YET (BCBD)
  A6B7  NO SECONDARY PATH NAME EITHER (Ø28Ø)
  A6BD  CURRENT SLOT = DEFAULT SLOT (BE61)
  A6C3  CURRENT DRIVE = DEFAULT DRIVE (BE62)
  A6C8  BUFFER ALLOCATION = HIMEM (BC88)
  A6CB  GET LENGTH OF COMMAND NAME (BE52)
  A6DØ  ALLOW 2 MORE CHARACTERS FOR NOW (BCAA)
  A6D3  ARE ANY PARAMETERS PERMITTED? (BE54)
  A6D6  NO...MUST BE MON OR NOMON >>A736
  A6D8  YES, IN# OR PR#?
  A6D9  YES... >>A739
  A6DB  ELSE, REPARSE THE COMMAND <AA1B>
  A6EØ  FOR THIS COMMAND... (BE54)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A6E3
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

 A6E3  DOES THE PREFIX NEED FETCHING? >>A6EA
 A6E5  YES,
 A6E7  MLI: GET PREFIX FROM DEFAULT DRIVE <BE70>
 A6EA  ---
 A6EC  END OF LINE? >>A736
 A6EE  NO, COMMA?
 A6F0  NO >>A6F5
 A6F2  YES, NO FILENAME, LOOK FOR KEYWORDS >>A787
 A6F5  "/"?
 A6F7  YES >>A6FD
 A6F9  NO, ALPHABETIC?
 A6FB  NO...FILE NAMES MUST BEGIN THAT WAY >>A72F
 A6FD  ---
 A6FE  DON'T FLUSH ANY BLANKS OUT OF PATHNAME
 A703  ALLOW 64 CHARACTERS NEXT PARSE
 A709  PARSE NEXT OPERAND ON LINE <AAIF>
 A70D  SAVE ITS LENGTH  (BCBC)
 A712  FOUND A PATHNAME#I (BE56)
 A715  COPY PARM KEYWORD TO $280 (BCBC)
 A718  (ASSUMING PATHNAME1=PATHNAME2) (0280)
 A71F  CHECK NEXT CHAR (OTHER THAN A BLANK) <AA3A>
 A722  NOT COMMA OR RETURN, BAD! >>A72C
 A724  RETURN? >>A798
 A726  NO, PATHNAME EXPECTED NOW? (BE54)
 A72A  YES, ALL IS WELL >>A762
 A72C  NO, "SYNTAX ERROR" >>A839
 A72F  NON ALPHA FILE NAME, CHECK COMMAND NUMBER (BE53)
 A732  IS IT "RUN"
 A734  NO, ERROR >>A72C
 A736  YES, ITS OK THEN (MIGHT BE "RUN I00") >>A798
 A739  IN#S/PR#S, REPARSE COMMAND <AAIB>
 A73C  RETURN FOUND - ERROR >>A72C
 A73E  "A"?  (ADDRESS KEYWORD)
 A740  IF SO, GO PARSE THAT KEYWORD ONLY >>A78C
 A742  ELSE, ZERO ACCUMULATOR <AB37>
 A745  CONVERTING ONE BYTE'S WORTH (BCAD)
 A74A  PUT IT IN PR#/IN# SLOT VALUE AREA (BCAE)
 A74F  FOUND SLOT FOR PR#/IN# (BE56)
 A752  CONVERT SLOT # <A960>
 A755  ERROR? >>A76I
 A757  GET CONVERTED VALUE (BE6B)
 A75A  >8?
 A75C  NO, ITS OK >>A79I
 A75E  YES, "RANGE ERROR"
 A76I  RETURN
 A762  SECOND PATHNAME EXPECTED?
 A763  NO >>A787
 A765  YES, FLUSH TO NON-BLANK <AA3A>
 A768  NOTHING ELSE ON LINE???? >>A72C
 A76B  DON'T FLUSH ANY BLANKS OUT OF PATHNAME
 A772  COPY SECOND PATHNAME TO $281 <AA00>
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A777
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

 A777  SAVE IT'S LENGTH (LESS I) (0280)
 A77C  FOUND PATHNAME1 AND PATHNAME2 (BE56)
 A780  GET LAST CHARACTER AGAIN <AA3A>
 A783  IF NOT COMMA OR RETURN, "SYNTAX ERROR" >>A72C
 A785  RETURN? >>A798
 A787  NO, COMMA, FLUSH TO NON-BLANK <AA3A>
 A78A  SYNTAX ERROR IF TWO COMMAS IN A ROW >>A72C
 A78C  LOOKUP KEYWORD CHAR AND PARSE ITS VALUE <A8E8>
 A78F  EXIT NOW? >>A761
 A791  NO, FLUSH TO NON-BLANK <AA3A>
 A794  SYNTAX ERROR IF COMMA OR RETURN NOT FOUND  >>A72C
 A796  COMMA? YES, GO GET NEXT KEYWORD >>A787

 A798  GET PARSED SLOT (BE6I)
 A79B  MUST BE NON-ZERO >>A75E
 A79D  AND LESS THAN 8
 A79F  OR ELSE - "RANGE ERROR" >>A75E
 A7A1  CHECK DRIVE TOO (BE62)
 A7A6  MUST BE EITHER I OR 2
 A7AD  IS THIS A DEFERRED COMMAND?
 A7B0  NO... >>A7BB
 A7B2  YES, IS A PROGRAM RUNNING? (BE42)
 A7B5  YES >>A7BB
 A7B7  NO, "NOT DIRECT COMMAND"
 A7BA  RETURN
 A7BB  EXPECTING NO PATHNAMES? >>A7FD
 A7BD  NO... (BE55)
 A7C0  ARE S AND D VALID FOR THIS CMD?
 A7C2  NO >>A7FD
 A7C4  YES, HAVE WE GOT PATHNAMEI? (BE56)
 A7C8  YES >>A7D3
 A7CD  IS PATHNAME REQUIRED?
 A7CF  YES, "SYNTAX ERROR" >>A839
 A7D1  NO, OPTIONAL - NO PREFIX FETCH THEN >>A7FD
 A7D6  DOES PATHNAMEI START WITH A "/"?
 A7D8  YES, FULLY QUALIFIED >>A7DF
 A7DA  NO, IS THERE A PREFIX ACTIVE? (BF9A)
 A7DD  NO >>A7F8
 A7DF  YES, (BE57)
 A7E2  SLOT/DRIVE GIVEN WITH THIS COMMAND?
 A7E4  NO, FORGET IT >>A7FD
 A7E6  YES, DO WE HAVE PATHNAME ALSO? >>A7F8
 A7E8  NO,
 A7EA  NULL OUT PATHNAMEI (BCBC)
 A7F2  MARK THAT WE WILL HAVE ONE SOON (BE56)
 A7F8  ADD PREFIX TO FILENAMES <A83D>
 A7FB  ERROR? >>A83B
 A7FD  GET COMMAND NUMBER (BE53)
 A800  *2 AS INDEX INTO TABLE
 A802  GET ADDRESS OF COMMAND HANDLING ROUTINE (B8E9)
 A80B  AND STORE IT FOR INDIRECT JMP (BCAC)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A810
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A810  EXTERNAL COMMAND? IF SO GO NOW! >>A836
  A812  MY OWN COMMAND, "PREFIX"?
  A814  YES, GO NOW >>A836
  A819  S OR D VALID KEYWORDS FOR THIS CMD?
  A81B  NO, GO NOW >>A836
  A820  PATHNAME1 GIVEN WITH THIS COMMAND?
  A821  NO, GO NOW >>A836
  A823  YES, GET FILE INFO FOR PATHNAME1 <B7D0>
  A826  NO ERRORS I HOPE >>A836
  A828  ERROR WAS PATH NOT FOUND?
  A82A  NO, REAL ERROR - SAY SO >>A83B
  A82F  CAN WE CREATE PATHNAME1?
  A831  YES, OK THEN >>A836
  A833  ELSE, "PATH NOT FOUND"
  A835  RETURN
  A836  GO TO COMMAND HANDLING ROUTINE >>BCAB

A839 ********** SYNTAX ERROR ***************************************

  A839  LOAD BI CODE FOR "SYNTAX ERROR"
  A83B  AND RETURN WITH ERROR CONDITION
  A83C  RETURN

A83D ********** ADD PREFIX TO PATHNAMES ****************************

  A83D  GET SLOT NUMBER (BE61)
  A844  PUT SLOT IN HIGH 3 BITS
  A846  ADD DRIVE TO TOP BIT AND SHIFT SLOT DOWN (BE62)
  A84E  ...TO FORM THE UNIT NUMBER (BEC7)
  A853  READ THE PATHNAME PREFIX TO $201 (BEC8)
  A85D  MLI: ONLINE <BE70>
  A860  ERROR? >>A83B
  A865  DEFAULT DRIVE = PARSED DRIVE (BE3D)
  A86B  DEFAULT SLOT = PARSED SLOT (BE3C)
  A871  PATHNAME1 STARTS WITH "/"?
  A873  THEN ITS ALREADY GOT A PREFIX >>A8E6
  A878  ELSE, GET LENGTH OF PATHNAME
  A87A  BUMP IT BY 2 (TO ALLOW FOR /'S)
  A882  WITH PREFIX WILL IT EXCEED 64 CHARS?
  A887  YES, "SYNTAX ERROR"  >>A8E7
  A889  NO, UPDATE LENGTH TO INCLUDE PREFIX (BCBC)
  A88F  ---
  A893  AND COPY PATHNAME1 FORWARD TO MAKE ROOM (BCBD)
  A89C  PUT A "/" AT THE BEGINNING
  A8A1  AND AT THE END (BCBD)
  A8A4  COPY PREFIX JUST READ TO START OF PATHNAME1 (0200)
  A8AA  GET COMMAND NUMBER (BE53)
  A8AD  "OPEN"?
  A8AF  YES, DONE NOW! >>A8E6
  A8B1  "APPEND"?
  A8B3  YES, DONE NOW! >>A8E6
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A8B5
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A8B5  "EXEC"?
  A8B7  YES, DONE NOW! >>A8E6
  A8B9  ELSE, GET LENGTH OF PATHNAME2 (0280)
  A8BE  COMBINE THIS WITH PREFIX LENGTH (0201)
  A8C1  MORE THAN 64 CHARS?
  A8C6  IF SO, "SYNTAX ERROR" >>A8E7
  A8C8  UPDATE LENGTH (0280)
  A8CB  ---
  A8CF  COPY PATHNAME2 FORWARD TO MAKE ROOM (0281)
  A8D8  PUT A "/" IN FIRST
  A8DD  THEN THE PREFIX AND ANOTHER SLASH (0281)
  A8E6  ---
  A8E7  DONE!

A8E8 ********** KEYWORD LOOKUP ***************************************

  A8E8  ZERO THE ACCUMULATOR <AB37>
  A8EB  NINE POSSIBLE KEYWORDS IN TABLE
  A8ED  COMPARE AGAINST EACH (B96B)
  A8F0  FOUND IT? >>A927
  A8F5  NO, IS IT "T"? (FILE TYPE)
  A8F7  YES, OK THEN >>A8FC
  A8F9  ELSE, BAD KEYWORD >>A839
  A8FC  IT'S "T", IS IT PERMITTED ON THIS CMD?
  A901  NO, ERROR >>A923
  A906  ELSE, MARK WE HAVE "T" (BE56)
  A90B  START WITH TYPE INDEX OF 0 (BCAD)
  A910  INDICATE WHERE T VALUE IS TO GO (BCAE)
  A913  AND GO PARSE ONE CHAR <AA3A>
  A916  NOTHING THERE??? >>A8F9
  A918  IS IT A $?
  A91A  YES, HE GAVE TYPE IN HEX >>A976
  A91C  IS IT ALPHABETIC?
  A91E  NO, CONVERT DECIMAL TYPE >>A960
  A920  ELSE, GO LOOKUP TYPE NAME IN TABLE >>A9B6

  A923  ---
  A924  "INVALID PARAMETER"
  A926  RETURN

  A927  GET BIT POSITION OF THIS KEYWORD (B975)
  A92A  IGNORE "V" >>A947
  A92C  IS THIS KEYWORD PERMITTED? (BE55)
  A92F  NO, NOT WITH THIS COMMAND ANYWAY >>A923
  A931  S OR D?
  A933  NO >>A941
  A935  YES, ALREADY FOUND IT ON THIS LINE? (BE57)
  A938  YES, DON'T CHANGE DRIVE DEFAULT >>A947
  A93A  ELSE, ASSUME DRIVE = 1
  A941  MARK WE HAVE SLOT/DRIVE (BE57)
  A947  GET SIZE-1 IN BYTES OF VALUE (B97F)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A954
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A954  AND OFFSET TO VALUE IN STORAGE AREA (BCAE)
  A957  FLUSH TO NON-BLANK <AA3A>
  A95A  NOTHING ELSE THERE? >>A9B0
  A95C  IS NEXT CHAR A "$"?
  A95E  YES, GO CONVERT HEX - ELSE, FALL THRU >>A976

A960 *********** CONVERT DECIMAL NUMBER ******************************

  A960  SAVE LINE INDEX (BE4B)
  A963  CONVERT/ADD ONE DECIMAL DIGIT TO ACCUM <AA5C>
  A966  OK.. >>A96C
  A968  OVERFLOW? THEN "RANGE ERROR" >>A9B3
  A96A  BAD DIGIT? THEN "SYNTAX ERROR" >>A9B0
  A96C  RESTORE LINE INDEX (BE4B)
  A96F  FLUSH TO NEXT NON-BLANK <AA3A>
  A972  AND GO BACK TO CONVERT NEXT DIGIT >>A960
  A974  ALL DONE, END OF LINE OR COMMA >>A98F

A976 *********** CONVERT HEX NUMBER **********************************

  A976  FLUSH TO NEXT NON-BLANK (SKIP "$")  <AA3A>
  A979  NOTHING LEFT? >>A9B0
  A97B  SAVE LINE INDEX (BE4B)
  A97E  CONVERT HEX DIGIT <AAAE>
  A9B1  OK.. >>A987
  A983  OVERFLOW? THEN "RANGE ERROR" >>A9B3
  A985  BAD DIGIT? THEN "SYNTAX ERROR" >>A9B0
  A987  RESTORE LINE INDEX (BE4B)
  A98A  FLUSH TO NEXT NON-BLANK <AA3A>
  A98D  AND GO CONVERT NEXT DIGIT >>A97B

A98F *********** STORE KEYWORD VALUE **********************************

  A98F  HOW MANY BYTES TO CHECK?
  A994  ALL HAVE BEEN CHECKED? >>A99E
  A996  NO, INSURE MSB'S OF ACCUM ARE ZERO (BCAF)
  A999  IF NUMBER IS A SHORT INTEGER >>A9B3
  A9A1  COPY ACCUM TO PROPER PARM STORAGE CELL (BCAF)
  A9AB  RESTORE LINE INDEX (BE4B)
  A9AF  AND EXIT

  A9B0  "SYNTAX ERROR" JUMP >>AB39
  A9B3  "RANGE ERROR" JUMP >>A75E

A9B6 *********** STORE KEYWORD VALUE **********************************

  A9B6  ---
  A9B8  COPY 3 CHARACTER TYPE TO ACCUM (BCAF)
  A9BE  (COPIED ALL 3?) >>A9C7
  A9C0  (GET NEXT CHAR IGNORING BLANKS) <AA3A>
  A9C5  MUST HAVE 3 CHARACTERS! >>A9B0
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: A9C7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A9C7  SAVE LINE INDEX (BE4B)
  A9CA  INITIALIZE NAME INDEX TO ZERO
  A9CF  HAVE ALL 13 BEEN CHECKED?
  A9D1  YES, NO MATCH >>A9B0
  A9D4  ELSE, INDEX*3 (BCAD)
  A9D8  COMPARE TYPE GIVEN (BCAF)
  A9DB  TO TYPES IN TABLE (B997)
  A9DE  (IGNORE MSB'S)
  A9DF  NO MATCH ALREADY... >>A9E9
  A9E3  ELSE,
  A9E5  CHECK ALL THREE CHARS >>A9D8
  A9E7  THEY ALL MATCH! WE FOUND IT >>A9EE
  A9E9  NOT THE RIGHT ONE,  (BCAD)
  A9EC  GO TRY THE NEXT ONE >>A9CA
  A9EE  REVERSE NAME INDEX
  A9F5  AND GET TYPE VALUE FROM TABLE (B989)
  A9F8  STORE IT IN TYPE VALUE STORAGE AREA (BE6A)
  A9FB  RESTORE LINE INDEX (BE4B)
  A9FF  AND EXIT

AA00 *********** COPY PATHNAME2 ***********************************

  AA00  GET NEXT CHARACTER <AA4A>
  AA03  AND STORE IT INDEXED OFF $280 (02B0)
  AA07  COMMA?
  AA09  YES, DONE >>AA37
  AA0B  BLANK?
  AA0D  YES, DONE >>AA37
  AA0F  RETURN?
  AA11  YES, OUT NOW >>AA4B
  AA13  PATHNAME TOO LONG? (BCAA)
  AA16  NO, CONTINUE COPYING >>AA00
  AA18  ELSE, SET NOT-EQUAL CONDITION
  AA1A  AND EXIT

AA1B *********** COPY COMMAND NAME INTO TXTBUF ***********************

  AA1B  SET INDICIES
  AA1F  GET NEXT NON-BLANK <AA4A>
  AA22  COPY TO TXTBUF (BCBD)
  AA26  COMMA?
  AA28  YES, DONE >>AA37
  AA2A  BLANK?
  AA2C  YES, DONE >>AA37
  AA2E  RETURN?
  AA30  YES, DONE >>AA48
  AA32  AT MAX LENGTH (8)? (BCAA)
  AA35  NO, CONTINUE >>AA1F
  AA37  ELSE, SET NOT-EQUAL CONDITION
  AA39  AND EXIT
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AA39
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

AA3A ********** FLUSH TO NON-BLANK **********************************
         Z-FLAG SET IF COMMA OR RETURN FOUND
         C-FLAG SET IF COMMA

  AA3A  IGNORE BLANKS
  AA3F  GET NEXT NON-BLANK <AA4A>
  AA42  COMMA?
  AA44  YES, OUT >>AA49
  AA46  RETURN?
  AA48  EXIT INDICATING WHAT WE FOUND
  AA49  RETURN

AA4A ********** GET NEXT CHARACTER **********************************

  AA4A  GET NEXT CHAR IN INPUT LINE (0200)
  AA4D  FORCE OFF MSB
  AA4F  LOWER CASE?
  AA51  NO >>AA55
  AA53  YES, FORCE UPPER CASE
  AA55  BUMP LINE INDEX
  AA56  IS THIS A FLUSH CHARACTER (LIKE BLANK)? (BCA9)
  AA59  YES, GO GET NEXT ONE >>AA4A
  AA5B  ELSE, RETURN WITH IT

AA5C ********** CONVERT DIGIT AND ADD TO ACCUM **********************

  AA5C  NUMERIC?
  AA5E  NO >>AA64
  AA62  YES >>AA68
  AA64  NOT NUMERIC, EXIT WITH CARRY SET
  AA65  AND Z-FLAG RESET
  AA67  RETURN
  AA68  ISOLATE DECIMAL PORTION OF DIGIT
  AA6B  CURRENT VALUE OF ACCUM... (BCBI)
  AA6E  >1,703,936?
  AA70  YES, OVERFLOW >>AA94
  AA74  PUSH ENTIRE ACCUM ONTO STACK (BCAF)
  AA7B  ACCUM*2 (ROL IT ONCE) <AAD7>
  AA7E  ACCUM*4 (AND AGAIN) <AAD7>
  AA84  ---
  AA85  ACCUM*4+ACCUM --> ACCUM*5 (BCAF)
  AA9I  FINALLY, ACCUM*5*2 --> ACCUM*I0 <AAD7>
  AA94  ---
  AA95  ACCUM OVERFLOW? >>AAAA
  AA97  NO, ADD NEW DIGIT TO ACCUM (BCAF)
  AA9A  AND STORE IT (BCAF)
  AA9D  NO CARRY? >>AAAD
  AAA0  GOT CARRY, PROPAGATE IT THRU ACCUM (BCB0)
  AAAA  OVERFLOW ERROR
  AAAD   NORMAL EXIT
```

```
BASIC Interpreter (BI) -- VI.I.I -- 18 JUN 84   NEXT OBJECT ADDR: AAAD
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

AAAE ********** CONVERT HEX DIGIT AND ADD ***************************

  AAAE  NUMERIC?
  AAB0  NO >>AABE
  AAB4  YES >>AAC4
  AAB6  NON-NUMERIC, HOW BOUT "A" THRU
  AABA  "F"
  AABC  YES! >>AAC2
  AABE  ---
  AABF  NO, GET OUT NOW
  AAC1  RETURN
  AAC2  "A" THRU "F", CONVERT TO $BA-$BF
  AAC4  ISOLATE DIGIT
  AAC8  SHIFT ACCUM 4 BITS LEFT TO MAKE ROOM <AAD7>
  AACB  (WATCH OUT FOR OVERFLOW) >>AAAA
  AAD0  OR IN NEW NIBBLE (BCAF)
  AAD3  AND REPLACE IN ACCUM LSB (BCAF)
  AAD6  DONE

AAD7 ********** SHIFT 3 BYTE ACCUM LEFT A BIT ***********************

  AAD7  SHIFT THE THREE BYTE WORK ACCUM (BCAF)
  AAE0  RETURN

AAEI ********** SCAN CMD TABLE FOR COMMAND ***************************

  AAEI  START WITH LAST COMMAND IN TABLE
  AAE6  IS IT A "-" COMMAND? (BCBD)
  AAEB  NOPE >>AAF5
  AAED  YES, SPECIAL COMMAND NUMBER (BE53)
  AAF0  ZERO LENGTH COMMAND STRING (BE52)
  AAF3  CONTINUE >>ABI2
  AAF5  FIRST COMMANDS IN TABLE ARE 8 CHARS
  AAFA  GET INDEX TO NEXT NAME (B858)
  AAFD  SAME LENGTH AS LAST NAME? >>AB05
  AAFF  NO,
  AB02  NAMES ARE ONE BYTE SHORTER FROM NOW ON (BE52)
  AB05  ---
  AB06  COMPARE HIS NAME TO MY TABLE (BCBD)
  AB0C  NOT IT... >>AB25
  AB10  COMPARE ENTIRE NAME >>AB06

  ABI2  FOUND IT! GET COMMAND INDEX (BE53)
  AB15  *2 FOR MOST THINGS
  ABI7  PICK UP PERMITTED PARMS BITS (B92A)
  AB23  EXIT HAPPILY
  AB24  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AB24
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  AB25  NOT THE ONE, SKIP TO NEXT (BE52)
  AB2E  IF THERE ARE ANY MORE >>AAFA
  AB30  ELSE, NO SUCH COMMAND (BE53)
  AB34  XRETURN THRU $BE06 VECTOR >>BE06

AB37 *********** ZERO THREE BYTE ACCUM ******************************

  AB37  ZERO THE THREE BYTE WORK
  AB39  ...ACCUMULATOR (BCAF)
  AB42  RETURN

AB43 *********** "-" COMMAND ***************************************

  AB43  CHECK FILE TYPE (BEB8)
  AB46  APPLESOFT PROGRAM?
  AB48  YES, "RUN" IT >>ABB2
  AB4A  BINARY FILE?
  AB4C  YES, "BRUN" IT >>AB8D
  AB4E  TEXT FILE?
  AB50  NO >>AB55
  AB52  YES, "EXEC" IT >>B221
  AB55  SYS FILE?
  AB57  YES, GO RUN IT >>AB5D
  AB59  ELSE, "FILE TYPE MISMATCH"
  AB5C  RETURN

        ******** RUN "SYS" FILE *****************

  AB5D  CLOSE ALL OPEN FILES <B4F2>
  AB60  CLOSE EXEC <B2FB>
  AB65  LSB OF A$ IS 00 (BE58)
  AB68  FREE UP ALL OF BI'S MEMORY (BF6B)
  AB7B  A$2000 IS WHERE IT WILL LOAD (BE59)
  AB80  TYPE IS "SYS" (BE6A)
  AB8A  FORCE, T, PATHNAME1, AD PARMS (BE56)
  AB8D  GO DO A STANDARD BRUN >>AE16

AB90 *********** "CHAIN" COMMAND ***********************************

  AB90  SQUASH VARIABLES UP AGAINST HIMEM <A40D>
  AB95  SAVE HIMEM  (BC7B)
  AB9C  SET NEW HIMEM BELOW COMBINED VARS
  AB9E  LOAD FILE (LEAVE OTHERS OPEN) <AC03>
  ABA4  RESTORE OLD HIMEM
  ABA6  ERROR? >>AC14
  ABA8  NO, CLEAR VARIABLES <D665>
  ABAB  REEXPAND VARIABLES DOWN AGAINST LOMEM <A472>
  ABB0  THEN GO "RUN" PROGRAM >>ABC7
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: ABB0
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

ABB2 *********** "RUN" COMMAND ***************************************

  ABB2  NO INPUT FILE ACTIVE NOW
  ABB7  NO APPLESOFT ERROR NUMBER
  ABBC  GOT PATHNAME1?
  ABBD  NO, ERROR >>ABD5
  ABBF  YES, LOAD PROGRAM <ABFE>
  ABC2  ERROR? >>AC14
  ABC4  NO, CLEAR VARIABLES <D665>

  ABC7  CLEAR ERROR FLAG
  ABC9  POSITION TO LINE NUMBER IF GIVEN <AC97>
  ABCC  RESTORE MY INTERCEPTS <9A8D>
  ABCF  CLEAR COMMAND NUMBER ETC., MODE = 4 <ABD5>
  ABD2  JUMP INTO APPLESOFT TO RUN PROGRAM >>D7D2

ABD5 *********** CLEAR COMMAND NUMBER ETC. ***************************

  ABD5  SET NORMAL (NON-INVERSE OR FLASH) <F273>
  ABDA  SEARCH CHARACTER FOR TRACE IS "#" (9F61)
  ABDF  NO COMMAND NUMBER NOW (BE53)
  ABE2  NO PROMPT
  ABE6  SET MODE=4 (DEFERRED) <9F76>
  ABE9  "SYNTAX ERROR" IF THINGS GO WRONG >>A839

ABEC *********** "LOAD" COMMAND ***************************************

  ABEC  LOAD PROGRAM <ABFE>
  ABEF  ERROR? IF NOT, FALL THRU TO WARMSTART >>AC14

ABF1 *********** WARMDOS: WARMSTART BI ********************************

  ABF1  CLEAR APPLESOFT, RESET POINTERS <D665>
  ABF4  RESET MODE/SET INTERCEPTS <9A17>
  ABF9  CURSOR HORIZ. = 0 (START OF LINE)
  ABFB  GO WARMSTART APPLESOFT >>D43F

ABFE *********** LOAD A PROGRAM ***************************************

  ABFE  CLOSE ALL OPEN FILES <B4F2>
  AC01  ERROR? >>AC14
  AC03  GO LOAD FILE  <AC15>
  AC06  ERROR? >>AC14
  AC08  SET LOMEM = ARRAYS = FREESTART
  AC0A  ALL TO END OF PROGRAM LOADED
  AC14  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AC14
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

AC15 *********** READ A PROGRAM FROM A FILE *************************

  AC15  READ REQUESTED
  AC17  TYPE = BAS ASSUMED
  AC19  OPEN THE FILE <B194>
  AC1C  ERROR? >>AC14
  AC20  MLI: GET EOF <BE70>
  AC23  ERROR? >>AC14
  AC27  APPLESOFT PROGRAM START --> READ DATA (BED7)
  AC2A  ADD TO THAT THE EOF MARK TO ... (BEC8)
  AC2D  SET AD PARM --> END OF PROGRAM IMAGE (BE58)
  AC3B  OVERFLOW? >>AC3F
  AC3D  NO, WOULD PROGRAM EXCEED HIMEM?
  AC3F  IF SO...
  AC41  "PROGRAM TOO LARGE" >>AC14
  AC43  ELSE, PICK UP LENGTH AGAIN (BEC8)
  AC49  AND GO READ IT IN <AF98>
  AC4C  ERROR? >>AC14
  AC4E  CLOSE FILE <AF94>
  AC51  ERROR? >>AC14
  AC53  RELOCATE PROGRAM IF NECESSARY <AC61>
  AC5C  COPY AD PARM TO APPLESOFT PGM END PTR
  AC60  RETURN

AC61 *********** RELOCATE APPLESOFT PROGRAM *************************

  AC61  ---
  AC62  WAS APPLESOFT PROGRAM SAVED FROM SAME
  AC64  MEMORY LOCATION? (BEB9)
  AC73  YES, NOTHING TO DO THEN >>ACBA
  AC79  ELSE, LOOP THROUGH PROGRAM
  AC7B  ADJUSTING ALL ADDRESSES TO
  AC7D  THE NEW LOAD LOCATION

AC97 *********** POSITION TO LINE NUMBER ****************************

  AC97  WAS A LINE NUMBER PARM GIVEN? (BE57)
  AC9D  NO, NEVER MIND >>ACBA
  AC9F  COPY L KEYWORD VALUE TO APPLESOFT'S LINE # (BE68)
  ACA9  THEN CALL APPLESOFT TO FIND THE LINE <D61A>
  ACAF  SUBTRACT ONE FROM THE ADDRESS
  ACB1  AND POINT APPLESOFT'S GETCHR SUBROUTINE
  ACB3  AT IT (SO NEXT CHAR READ WILL BE FIRST
  ACB5  CHARACTER ON THE LINE).
  ACBA  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: ACBA
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

ACBB *********** "SAVE" COMMAND ***************************************

  ACBB  DOES FILE EXIST ALREADY? >>ACDF
  ACBD  NO, TYPE = BAS
  ACBF  IN T KEYWORD VALUE (BE6A)
  ACC2  AND MLI LIST (BEB8)
  ACC7  ALLOW ALL ACCESSES (READ/WRITE/ETC.) (BEB7)
  ACCC  SAVE PROGRAM START ADDRESS IN (BEA5)
  ACCF  AUXID'S (BEB9)
  ACDA  GO CREATE A NEW FILE <AD46>
  ACDD  ERROR? >>AD28

  ACDF  WRITE ACCESS REQUESTED
  ACE1  BAS TYPE FILE
  ACE3  OPEN IT <B194>
  ACE6  ERROR? >>AD28
  ACEB  SUBTRACT APPLESOFT PTRS TO COMPUTE
  ACED  LENGTH OF PROGRAM.
  ACEE  STORE THIS IN EOF MARK LIST (BEC8)
  ACFB  MSB OF EOF MARK IS 00 (<64K PGM) (BECA)
  AD00  POINT LIST TO PROGRAM AS DATA TO WRITE (BED7)
  AD08  WRITE A RANGE TO DISK FILE <AF9C>
  AD0B  ERROR? >>AD28
  AD0F  MLI: SET EOF (TO TRUNCATE OLD LONGER FILE) <BE70>
  AD12  ERROR? >>AD28
  AD14  CLOSE THE FILE <AF94>
  AD17  ERROR? >>AD28
  AD1B  DOES PROGRAM START MATCH AUXID IN FILE INFO?
  AD20  NO, CHANGE IT >>AD29
  AD28  ELSE, EXIT

  AD29  TO CHANGE IT, (BEB9)
  AD2F  EXIT THRU SET FILE INFO ROUTINE >>B7D9

AD32 *********** "CREATE" COMMAND *************************************

  AD32  AUXID = 0 (A$ OR RECLN)
  AD3D  TYPE KEYWORD GIVEN?
  AD3F  YES >>AD46
  AD43  NO, ASSUME TYPE = DIR (BE6A)

  AD46  *** CREATE FILE ENTRY *** (BE43)
  AD49  EXEC FILE ACTIVE?
  AD4C  HOW MANY FILES ARE OPEN INCLUDING EXEC? (BE4D)
  AD4F  8 OR MORE?
  AD51  YES, ERROR >>AD6E
  AD56  ELSE, SET TYPE IN MLI LIST (BEA4)
  AD59  FULL ACCESS (READ/WRITE/ETC.)
  AD5B  KIND = STANDARD FILE
  AD5D  DIR FILE WANTED?
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AD5F
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  AD5F  NO >>AD63
  AD61  YES, KIND = DIR FILE
  AD63  SET ACCESS (BEA3)
  AD66  AND KIND (BEA7)
  AD6B  MLI: CREATE (DON'T COME BACK HERE)  >>BE70

  AD6E  "RAM TOO LARGE" ERROR
  AD70  RETURN

AD71 ********** "RENAME" COMMAND ***********************************

  AD71  ---
  AD75  SECOND PATHNAME GIVEN?
  AD78  IF SO, GO MLI: RENAME >>AD7F
  AD7A  "SYNTAX ERROR" OTHERWISE >>A839

AD7D ********** "DELETE" COMMAND ***********************************

  AD7D  SETUP MLI: DELETE CALL TYPE
  AD7F  EXIT THRU MLI CALL >>BE70

AD82 ********** "LOCK" COMMAND *************************************

  AD82  GET FILE INFO FOR PATHNAME1 <B7D0>
  AD85  GET ACCESS CODES (BEB7)
  AD88  TURN OFF ALL...
  AD8A  BUT READ
  AD8F  THEN GO SET UPDATED FILE INFO >>B7E7

AD92 ********** "UNLOCK" COMMAND ***********************************

  AD92  GET FILE INFO FOR PATHNAME1 <B7D0>
  AD95  TURN ON ALL FILE ACCESSES
  AD9D  THEN GO SET UPDATED FILE INFO >>B7E7

ADA0 ********** "PREFIX" COMMAND ************************************

  ADA0  SLOT/DRIVE GIVEN ON COMMAND? (BE57)
  ADA6  IF SO, GOT OPERAND ALREADY >>ADAC
  ADA8  ELSE, (BE56)
  ADAB  CHECK FOR PATHNAME1
  ADAC  AND GO DO MLI: SET PREFIX ...
  ADAE  IF IT'S THERE >>AD7F
  ADB0  ELSE, IS BASIC PROGRAM RUNNING?
  ADB2  IF SO, SET PREFIX ACTIVE FLAG >>ADD1
  ADB4  NO, NEW LINE <9FAB>
  ADBC  END OF NAME YET? >>ADC9
  ADBE  NO, COPY NAME IN PATHNAME1 BUFFER (BCBD)
  ADC3  TO OUTPUT DEVICE <9FAD>
  ADC9  AND SKIP A BLANK LINE <9FAB>
  ADD0  DONE
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: ADD0
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  ADD1  SET PREFIX ACTIVE FLAG
  ADD3  SO BASIC CAN READ THE PREFIX (BE46)
  ADD7  RETURN

ADD8 ********** "BSAVE" COMMAND ************************************

  ADD8  PATHNAME1 FOUND? >>AE0E
  ADDA  NO, NEW FILE (BE57)
  ADDD  AD, L, AND E POSSIBLE
  ADDF  AD AND EITHER L OR E REQUIRED
  ADE1  OR ELSE ERROR >>AE12
  ADE6  PUT AD IN CREATE PARAMETER LIST (BEA5)
  ADE9  AND IN GET FILE INFO LIST (BEB9)
  ADF7  TYPE = BIN ASSUMED (BE6A)
  AE00  T KEYWORD GIVEN?
  AE02  IF SO, ERROR >>AE12
  AE04  GO CREATE THE FILE <AD46>
  AE07  ERROR? >>AE14
  AE09  GET FILE INFO <B7D0>
  AE0C  ERROR? >>AE14
  AE0E  WRITING...
  AE10  GO PROCESS LIKE A BLOAD OTHERWISE >>AE25

  AE12  "PATH NOT FOUND" ERROR
  AE14  ---
  AE15  RETURN

AE16 ********** "BRUN" COMMAND *************************************
          (DOES NOT SET MODE=4 SO DOS COMMANDS MAY
          NOT BE ISSUED AS WITH A BASIC PROGRAM)

  AE16  BLOAD IT FIRST <AE23>
  AE19  ERROR? >>AE14
  AE1B  THEN CALL IT <AE20>
  AE1E  THEN EXIT
  AE1F  RETURN
  AE20  INDIRECT JMP TO BINARY PROGRAM >>BED7

AE23 ********** "BLOAD" COMMAND ************************************

  AE23  READING...
  AE25  TYPE = BIN
  AE27  OPEN THE FILE <B194>
  AE2A  ERROR? >>AE14
  AE2C  ASSUME USER SPECIFIED AD KEYWORD (BE58)
  AE35  IF SO, USE HIS ADDRESS >>AE47
  AE37  ELSE, USE AD IN FILE INFO AUXID (BEB9)
  AE40  WAS T KEYWORD GIVEN?
  AE42  YES, INVALID PARM (ONLY BIN IS LEGAL) >>AE78
  AE47  POINT READ/WRITE PARMS TO DATA (BED7)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AE4D
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  AE4D  PICK UP LENGTH FROM L KEYWORD VALUE (BE5F)
  AE53  WAS L OR E GIVEN?
  AE55  NEITHER >>AE7C
  AE57  BOTH?
  AE59  YES...NAUGHTY! >>AE78
  AE5B  E GIVEN?
  AE5D  NO, MUST BE L >>AE92
  AE5F  YES... (BE5D)
  AE63  COMPUTE L = (E - AD) (BE58)
  AE6F  PLUS ONE FOR INCLUSIVE RANGE >>AE72
  AE72  MAKE SURE NO BORROW OCCURED >>AE92

  AE74  OR ELSE, "RANGE ERROR"
  AE77  RETURN

  AE78  "INVALID PARM" ERROR
  AE7B  RETURN

  AE7C  ---
  AE7E  MLI: GET EOF <BE70>
  AE81  ERROR? >>AE90
  AE83  GET L (EOF MARK) (BEC8)
  AE89  BETTER NOT EXCEED 64K (BECA)
  AE8C  NO.. >>AE92

  AE8E  YES, "PROGRAM TOO LARGE"
  AE90  ---
  AE91  RETURN

  AE92  STORE LENGTH TO READ OR WRITE (BED9)
  AE9B  B KEYWORD GIVEN?
  AE9D  NO >>AEC4
  AEA1  YES, COPY B VALUE TO SET MARK LIST (BE5A)
  AEAA  ---
  AEAC  MLI: SET MARK <BE70>
  AEB2  NO ERROR? >>AEC4
  AEB4  ERROR, RANGE ERROR?
  AEB6  NO >>AE90
  AEB8  BSAVING (NOT BLOAD/BRUNING)?
  AEBA  NO >>AE90
  AEBE  MLI: FORCE EOF FORWARD TO MARK <BE70>
  AEC1  AND TRY SET MARK AGAIN >>AEAA
  AEC3  RETURN
  AEC4  GET COMMAND NUMBER (BE53)
  AEC7  ASSUME READ
  AEC9  BSAVE?
  AECB  NO, READ IS CORRECT >>AECF
  AECD  WRITING
  AECF  MLI: READ OR WRITE <BE70>
  AED2  ERROR? >>AE90
  AED4  THEN EXIT THRU CLOSE >>AF94
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AED4
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

AED7 ********** "STORE" COMMAND ***********************************

  AED7  PATHNAME1 EXISTS? >>AEEB
  AED9  NO, T = VAR BY DEFAULT
  AEE1  FULL ACCESS (READ/WRITE/ETC.)
  AEE6  CREATE THE FILE <AD46>
  AEE9  ERROR? >>AF39
  AEEB  COMPRESS APPLESOFT VARS AGAINST HIMEM <A40D>
  AEF4  OPEN "VAR" FILE FOR WRITE <B194>
  AEF7  ERROR? >>AF32
  AEF9  POINT TO INTERNAL 5 BYTE HEADER BUFFER <AF3A>
  AEFC  AND WRITE OUT LENGTHS OF VARS <AF9C>
  AEFF  ERROR? >>AF32
  AF01  STORE ADDRESS OF VARS (BC8E)
  AF04  IN READ/WRITE PARM LIST (BED7)
  AF07  AND FILE INFO AUXID (BEB9)
  AF13  GET LENGTH OF VARS (BC91)
  AF19  AND WRITE THEM OUT <AF9C>
  AF1C  ERROR? >>AF32
  AF20  MLI: GET MARK <BE70>
  AF25  MLI: SET NEW EOF (TRUNCATE IF NECESSARY) <BE70>
  AF28  ERROR? >>AF32
  AF2A  SET FILE INFO WITH AD OF VARS <B7D9>
  AF2D  ERROR? >>AF32
  AF2F  CLOSE FILE <AF94>
  AF32  ---
  AF34  REEXPAND VARS BACK AGAIN <A472>
  AF39  RETURN

AF3A ********** SETUP TO READ/WRITE VAR HDR ************************
         APPLESOFT VARIABLES HEADER CONSISTS OF:
         2 BYTE LENGTH OF SIMPLE+ARRAY VARIABLES
         2 BYTE LENGTH OF SIMPLE VARIABLES ONLY
         1 BYTE MSB OF HIMEM FOR THESE VARIABLES

  AF3A  STORE ADDRESS OF 5 BYTE INFO
  AF3C  IN READ/WRITE PARM LIST (BED7)
  AF46  LENGTH = 5
  AF48  RETURN

AF49 ********** "RESTORE" COMMAND *********************************

  AF49  TYPE = VAR
  AF4B  READING
  AF4D  OPEN THE FILE <B194>
  AF50  ERROR? >>AF39
  AF52  SET UP TO READ THE HEADER <AF3A>
  AF55  READ 5 BYTE HEADER <AF98>
  AF58  ERROR? >>AF39
  AF5A  PICK UP WHERE TO READ IN COMPRESSED VARS (BEB9)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AF5D
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  AF5D  FROM AUXID (BC8E)
  AF63  ADJUST MSB OF THIS BY THE DIFFERENCE
  AF66  BETWEEN HIMEM'S (NOW AND WHEN STORED) (BC8D)
  AF73  MAKE SURE VARS WON'T OVERLAY PROGRAM
  AF75  IF SO, ERROR >>AF90
  AF7F  COMPUTE LENGTH OF ALL VARS/STRINGS
  AF81  (HIMEM-START) (BC8F)
  AF85  GO READ COMBINED VARS INTO MEMORY <AF98>
  AF8B  ERROR? >>AF39
  AF8A  CLOSE THE FILE <AF94>
  AF8D  EXIT BY REEXPANDING THE VARS DOWN >>AF32

  AF90  "PROGRAM TOO LARGE" ERROR
  AF93  RETURN

AF94 *********** CLOSE FILE ***************************************

  AF94  SET MLI CLOSE OPCODE
  AF96  AND GO TO MLI >>AFA4

AF98 *********** READ/WRITE A RANGE *********************************

  AF98  READ MLI OPCODE
  AF9A  JUMP IN >>AF9E
  AF9C  WRITE MLI OPCODE
  AF9E  STORE LENGTH (BEDA)
  AFA4  EXIT THRU MLI:READ OR WRITE >>BE70

AFA7 *********** "PR#" COMMAND ***************************************

  AFA7  USE CSWL AND OUTVEC
  AFAC  JUMP TO COMMON CODE >>AFB5

AFAE *********** "IN#" COMMAND ***************************************

  AFAE  USE KSWL
  AFB3  AND INVEC

  AFB5  OR IN SLOT GIVEN BY USER (BE6B)
  AFB8  *2 FOR USE AS INDEX INTO TABLE
  AFBD  WAS SLOT PARAMETER GIVEN?
  AFBF  NO... >>AFD2
  AFC1  YES, (BE57)
  AFC4  AD GIVEN? >>AFE7
  AFC6  NO, GET INVEC OR OUTVEC FOR THIS SLOT (BE10)
  AFC9  AND STORE ON AD KEYWORD VALUE (BE58)
  AFD2  VALIDITY CHECK I/O DRIVER <AFF9>
  AFD5  NO GOOD? >>AFE6
  AFD7  GET INDEX TO CSWL OR KSWL (BCA9)
  AFDD  AND REPLACE ONE OR THE OTHER WITH (0036)
  AFE0  HIS ADDRESS (BE59)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: AFE6
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  AFE6  RETURN

  AFE7  VALIDITY CHECK AD KEYWORD VALUE <AFF9>
  AFEA  NO GOOD? >>AFF8
  AFEC  GOOD, COPY VALUE TO INVEC OR OUTVEC (BE59)
  AFF8  EXIT BUT DON'T REDIRECT I/O NOW

AFF9 *********** VALIDITY CHECK I/O DRIVER ***************************

  AFF9  $3A/3B --> NEW HANDLER (FROM AD PARM) (BE58)
  B005  IS DRIVER IN MAIN RAM (BELOW $C000)?
  B007  YES >>B01E
  B009  NO, RESET I/O CARD ROMS (CFFF)
  B00C  USE $3C TO COUNT ITERATIONS
  B00E  TEST ROM AT USER'S ADDRESS
  B014  FOR STABILITY
  B018  256 TIMES
  B01C  MUST BE OK
  B01D  RETURN
  B01E  MAIN RAM I/O DRIVER
  B020  MUST START WITH A "CLD" INSTRUCTION
  B022  OK... >>B01C

  B024  ELSE, "NO DEVICE CONNECTED"
  B027  RETURN

B028 *********** "BYE" COMMAND ***************************************

  B028  CLOSE ANY OPEN FILES <B4F2>
  B02B  CLOSE EXEC FILE, IF ANY <B2FB>
  B030  MLI CALL: <BF00>
  B033  QUIT
  B034  USE READ PARMLIST BECAUSE QUIT DOESN'T NEED PARMS.

B036 *********** "CAT" COMMAND ***************************************

  B036  39 CHARACTERS PER LINE
  B038  THEN PROCESS LIKE "CATALOG" >>B03C

B03A *********** "CATALOG" COMMAND ***********************************

  B03A  79 CHARACTERS PER LINE
  B03C  STORE LINE LENGTH (BCB6)
  B042  TEST FOR T AND
  B044  ....PATHNAME1 GIVEN
  B045  GOT T >>B04A
  B047  NO T, T=0 (ANY TYPE WILL DO) (BE6A)
  B04A  GOT PATHNAME1 >>B051
  B04C  NO PATHNAME1, GET FILE INFO FOR PREFIX <B7D0>
  B04F  ERROR? >>B0B7
  B051  OPEN/READ DIRECTORY HEADER <B14A>
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B054
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  B054  ERROR? >>B0B7
  B056  SKIP TO A NEW LINE <9FAB>
  B059  FORMAT DIRECTORY'S NAME TO $201 <B0B8>
  B05C  PRINT $201 <9F9D>
  B05F  SKIP TO A NEW LINE <9FAB>
  B062  BLANK $201 BUFFER <A66C>
  B067  UNPACK HEADING MESSAGE LINE <9FB0>
  B06A  PRINT IT (40 OR 80 COLUMNS) <9F9D>
  B06D  SKIP TO A NEW LINE <9FAB>
  B073  ANY FILES IN THIS DIRECTORY? (BCBA)
  B076  NO >>B0A3
  B078  YES, READ NEXT ENTRY <B1D1>
  B07B  ERROR?  >>B0B7
  B07D  GET TYPE REQUESTED FOR SEARCH (BE6A)
  B080  ANY TYPE WILL DO? >>B087
  B082  NO, CHECK TYPE AGAINST THIS ENTRY (0269)
  B085  NOT IT, SKIP IT >>B08D
  B087  ELSE, FORMAT ENTRY TO $201 <A4C4>
  B08A  AND PRINT $201 <9F9D>
  B08D  CHECK KEYBOARD (C000)
  B090  FOR A CONTROL-C
  B092  IGNORE ANYTHING ELSE >>B09E

  B094  CONTROL-C, WHAT STATE ARE WE IN? (BE42)
  B097  DEFERRED >>B0A3
  B099  NO, IMMEDIATE, RESET KEYBOARD STROBE (C010)
  B09C  AND EXIT RIGHT NOW >>B0A3

  B09E  ELSE, ANY FILES LEFT IN COUNT? (BCBA)
  B0A1  YES, CONTINUE >>B078
  B0A3  ELSE, CLOSE DIRECTORY <AF94>
  B0A6  ERROR? >>B0B7
  B0A8  SKIP TO A NEW LINE <9FAB>
  B0AB  FORMAT BLOCKS FREE AND IN USE TO $201 <B0E7>
  B0AE  ERROR? >>B0B7
  B0B0  PRINT $201 <9F9D>
  B0B3  SKIP A LINE <9FAB>
  B0B7  DONE

B0B8 ********** FORMAT NAME OF DIRECTORY ****************************

  B0B8  BLANK $201 BUFFER <A66C>
  B0BB  FILE NAME IS AT +1 INTO DIR ENTRY
  B0BD  GET NAME LENGTH/TYPE (025D)
  B0C2  VOLUME DIRECTORY HEADER?
  B0C4  NO >>B0CA
  B0C6  YES, START NAME WITH "/" (0200)
  B0CA  ---
  B0CB  ISOLATE NAME LENGTH FROM TYPE
  B0CD  AND SET UP LENGTH TO COPY (0200)
  B0D2  COPY DIRECTORY NAME TO (0259)
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B0D7
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  B0D7  ...LINE (0200)
  B0E1  SET $200 TO MAXIMUM LENGTH
  B0E6  RETURN

B0E7 ********** FORMAT BLOCKS FREE/INUSE ****************************

  B0E7  POINT MLI:ONLINE PARMLIST
  B0E9  TO TXTBUF (PATHNAME1) (BEC8)
  B0F1  COPY DEVICE NUMBER (UNIT) (BF30)
  B0F9  MLI: ONLINE <BE70>
  B0FC  ERROR? >>B0B7
  B101  ISOLATE NAME LENGTH FROM BUFFER
  B104  BUMP BY ONE TO INCLUDE "/"
  B105  AND STORE IT AS A PREFIX (BCBC)
  B10A  STORE "/" AS FIRST CHARACTER (BCBD)
  B10D  GET FILE INFO FOR PREFIX <B7D0>
  B110  ERROR? >>B0B7
  B112  BLANK $201 BUFFER <A66C>
  B117  UNPACK "BLOCKS FREE: BLOCKS USED.." <9FB0>
  B11A  ZERO THE THREE BYTE ACCUM <AB37>
  B125  CONVERT AUXID (TOTAL BLOCKS) <A62F>
  B130  CONVERT BLOCKS USED <A62F>
  B137  BLOCKS_FREE = TOTAL_BLOCKS (BEBC)
  B13E  ... - BLOCKS_USED (BEBD)
  B145  CONVERT BLOCKS FREE <A62F>
  B149  DONE!

B14A ********** OPEN/READ DIRECTORY HDR ******************************

  B14A  READ ONLY
  B14E  CHECK FILE KIND (BEBB)
  B151  VOLUME DIRECTORY?
  B153  NO >>B158
  B155  YES, TYPE = DIR (BEB8)
  B158  OPEN THE FILE <B1A0>
  B15B  ERROR? IF NOT, FALL THRU >>B193

B15D ********** READ DIRECTORY HDR **********************************

  B15D  BUFFER IS $259
  B169  LENGTH IS $2B (ONE ENTRY) (BED9)
  B173  ML1: READ  <BE70>
  B176  ERROR? >>B193
  B17A  COPY ENTRY LENGTH, ENTRIES PER BLOCK, (027C)
  B17D  AND FILE COUNT FROM DIR HDR (BCB7)
  B183  STORE ENTRY LENGTH IN READ LENGTH NOW (BED9)
  B188  SET COUNTER TO FIRST ENTRY IN BLOCK (BCBB)
  B18D  MARK = 0 (START OF FILE) (BEC9)
  B193  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B193
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

B194 *********** OPEN FILE ***********************************************
          A REGISTER = ACCESS BITS
          X REGISTER = DEFAULT TYPE

  B194  ---
  B198  T KEYWORD GIVEN?
  B19A  NO >>B19F
  B19C  YES, USE KEYWORD VALUE INSTEAD (BE6A)
  B19F  ---
  B1A0  EXISTING FILE OF THIS TYPE? (BEB8)
  B1A3  NO, ERROR >>B1C9
  B1A5  CHECK ACCESS REQUESTED (BEB7)
  B1A8  REQUESTED ACCESS NOT PERMITTED >>B1CD
  B1AA  SET SYSTEM BUFFER IN OPEN PARM LIST (BC88)
  B1B2  LEVEL = $0F (BF94)
  B1B7  MLI: OPEN <BE70>
  B1BA  ERROR? >>B1C8
  B1BF  SAVE REFNUM IN READ/WRITE PARMLIST (BED6)
  B1C2  AND CLOSE PARMLIST (BEDE)
  B1C5  AND GET/SET EOF/MARK LIST (BEC7)
  B1C8  AND EXIT

  B1C9  "FILE TYPE MISMATCH"
  B1CC  RETURN
  B1CD  "FILE LOCKED"
  B1D0  RETURN

B1D1 ************ READ NEXT DIRECTORY ENTRY ***************************

  B1D1  FORCE MARK TO START OF THIS BLOCK (BEC9)
  B1D9  CHECK ENTRY NUMBER (BCBB)
  B1DE  LAST ENTRY IN THIS BLOCK? (BCB8)
  B1E1  NO >>B1ED
  B1E4  YES, ENTRY 0 NEXT TIME (BCBB)
  B1E7  BUMP MARK TO NEXT BLOCK  (BEC9)
  B1ED  ---
  B1EF  MARK POSITIONED TO PROPER ENTRY YET? >>B1F8
  B1F1  NO, BUMP POINTER TO NEXT ENTRY (BCB7)
  B1F4  AND CONTINUE IF STILL FIRST PAGE >>B1ED
  B1F6  JUST ENTERED SECOND PAGE >>B1EA
  B1F8  ADD 4 TO PTR TO ADJUST FOR BLOCK PREFIX
  B1FF  MLI: SET MARK <BE70>
  B202  ERROR? >>B21D
  B206  MLI: READ <BE70>
  B209  ERROR? >>B21D
  B20B  BUMP ENTRY COUNTER (BCBB)
  B211  IS THIS ENTRY VALID?
  B213  NO, SKIP OVER IT >>B1D1
  B215  DECREMENT FILE COUNT (BCB9)
  B21D  AND RETURN TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B21D
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

B21E *********** EXTERNAL COMMAND HANDLER ****************************

  B21E  INDIRECT JMP TO XTRNAD VECTOR >>BE50

B221 *********** "EXEC" COMMAND ***************************************

  B221  IS THIS FILE OPEN ALREADY? <B41F>
  B224  NO >>B250
  B226  YES, EXEC CLOSING? (BE4E)
  B229  NO >>B24C
  B22B  SAVE REFNUM (BEC7)
  B230  RESET MARK TO ZERO (BEC8)
  B23B  MLI: SET MARK <BE70>
  B23E  ERROR? >>B245
  B240  GET REFNUM AGAIN (BEC7)
  B243  GO RESTART THIS EXEC FILE FROM ITS START >>B2C3

        ******** CLOSE EXEC FILE ****************

  B245  PRESERVE CALLER'S AREG
  B246  AND CLOSE THE FILE <B2FB>
  B24B  THEN RETURN WITH ERROR

  B24C  "FILE BUSY" ERROR
  B24F  RETURN

        ******** CONTINUE EXEC SETUP ************

  B250  EXEC ACTIVE?  (BE43)
  B253  NO >>B25A
  B255  YES, CLOSE IT <B2FB>
  B258  ERROR? >>B263
  B25A  GET FILE TYPE (BEB8)
  B25D  SHOULD BE TXT
  B25F  IT IS >>B265

  B261  ELSE, "FILE TYPE MISMATCH"
  B263  RETURN WITH ERROR
  B264  RETURN

  B265  MOVE STRINGS TO MAKE ROOM FOR A BUFFER <A1F5>
  B268  NO ROOM? >>B263
  B26C  STORE NEW BUFFER ADDRESS IN PARM LIST (BEC8)
  B275  GET COUNT OF OPEN FILES (BE4D)
  B278  NO OTHERS CURRENTLY OPEN? >>B29E
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B27B
ADDR    DESCRIPTION/CONTENTS

        ******** MAKE EXEC TOPMOST BUFFER *******

  B27A  OTHERS ARE OPEN...
  B27C  OPENCOUNT*4 (4 PAGES PER BUFFER)
  B27E  ADD THIS TO MY BUFFER TO FIND TOP BUFFER (BC88)
  B282  SEARCH OPEN FILES TO FIND THE FILE WHICH (BC93)
  B285  IS USING THIS BUFFER... >>B28B
  B28A  IF IT IS NOT FOUND, BREAK!
  B28B  ---
  B28C  MOVE THAT FILE TO THE NEW BUFFER INSTEAD (BC93)
  B28F  GET THAT FILE'S REFNUM ALSO (BC9B)
  B297  MLI: SET BUFF <BE70>
  B29A  NO ERRORS? >>B29D
  B29C  IF ERROR, BREAK!
  B29D  ---

        ******** OPEN NEW EXEC FILE *************

  B29E  SET NEW BUFFER ALLOCATION PAGE (BC88)
  B2A1  SET UP OPEN LIST FOR EXEC TOO (BECF)
  B2A6  LEVEL = 0 (BF94)
  B2AB  MLI: OPEN (EXEC FILE) <BE70>
  B2AE  NO ERROR? >>B2B7

  B2B0  ---
  B2B1  IF ERROR, FREE BUFFER FIRST <A24C>
  B2B6  THEN EXIT WITH ERROR

  B2B7  SAVE BUFFNO FOR EXEC  (BECF)
  B2BD  AND REFNUM TOO (BED0)

        ******** COMPLETE EXEC COMMAND **********

  B2C3  SAVE READ REFNUM (BED6)
  B2C6  AND GET/SET REFNUM (BEC7)
  B2C9  AND NEWLINE REFNUM (BED2)
  B2CF  SET "L" VALUE FROM AUXID (BE5F)
  B2D8  SAVE PATHNAME/AUXID IN OPEN FILE TABLE <B3EB>
  B2DD  IGNORE MSB FOR END OF LINE CHARS (BED3)
  B2E2  MLI: SET NEWLINE <BE70>
  B2E8  WAS "F" OR "R" GIVEN ON COMMAND LINE?
  B2EA  NO >>B2F4
  B2EC  YES, POSITION TO SPECIFIED STARTING PT <B522>
  B2EF  NO ERRORS? >>B2F4
  B2F1  IF ERROR, GO CLOSE EXEC >>B245
  B2F4  MARK EXEC ACTIVE
  B2FA  AND RETURN TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B2FA
ADDR    DESCRIPTION/CONTENTS

B2FB ********** CLOSE EXEC FILE ************************************

  B2FB  EXEC ACTIVE? (BE43)
  B2FE  NO, SKIP IT >>B30B
  B300  INDICATE EXEC FILE CLOSING (BE4E)
  B305  PICK UP REFNUM FOR EXEC (BC9B)
  B308  AND GO CLOSE IT <B4A5>
  B30B  RETURN

B30C ********** "VERIFY" COMMAND ***********************************

  B30C  FILE NOT FOUND? >>B347
  B311  FILE FOUND, WAS A PATHNAME1 GIVEN?
  B313  YES >>B31D
  B315  NO,
  B317  PRINT "(C) APPLE COMPUTER..." <9F8C>
  B31A  AND A NEW LINE <9FAB>
  B31D  THEN EXIT
  B31E  RETURN

B31F ********** FLUSH ALL OPEN FILES *******************************

  B31F  REFNUM = 0 (ALL FILES)
  B321  JUMP INTO FLUSH >>B32F

B323 ********** "FLUSH" COMMAND ************************************

  B323  ---
  B326  WAS PATHNAME1 GIVEN?
  B328  NO, FLUSH ALL FILES >>B32F
  B32A  ELSE, LOOK UP NAME IN OPEN FILE LISTS <B41F>
  B32D  NOT AN OPEN FILE >>B337
  B32F  SAVE REFNUM IN PARM LIST (BEDE)
  B334  MLI: FLUSH <BE70>
  B337  EXIT

B338 ********** "OPEN" COMMAND *************************************

  B338  ---
  B339  LOOK UP NAME IN OPEN FILE LIST <B41F>
  B33C  NOT CURRENTLY OPEN? >>B34B

  B33E  ---
  B33F  IT IS OPEN, "FILE BUSY" ERROR
  B342  RETURN
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B342
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

 B343  "FILE TYPE MISMATCH" ERROR
 B346  RETURN

 B347  "PATH NOT FOUND" ERROR
 B349  ---
 B34A  RETURN

 B34B  ---
 B34C  ASSUME "L" IS ZERO
 B353  WAS "L" KEYWORD GIVEN?
 B355  YES, USE HIS VALUE >>B35D
 B357  NO, SET "L" TO ZERO (BE60)
 B360  WAS "T" GIVEN?
 B364  YES, USE HIS TYPE >>B36B
 B366  ELSE, DEFAULT TO "TXT"
 B36B  DOES THE FILE ALREADY EXIST? >>B38E
 B36D  NO, "T" GIVEN? IF SO, ERROR >>B347
 B36F  FORCE TYPE = "TXT" (BEB8)
 B374  FULL ACCESS (BEB7)
 B37A  COPY "L" KEYWORD VALUE (BE5F)
 B37D  TO CREATE (BEA6)
 B380  AND SET FILE INFO LISTS (BEBA)
 B389  GO CREATE THE FILE <AD46>
 B38C  ERROR? >>B349
 B38E  CHECK FILE TYPE (BEB8)
 B391  AGAINST HIS "T" VALUE (BE6A)
 B394  MISMATCH? >>B343
 B396  NO, TYPE = TXT?
 B398  NO >>B3AD
 B39A  YES, GET RECORD LENGTH FROM AUXID  (BEBA)
 B3A3  WAS "L" KEYWORD VALUE GIVEN?
 B3A5  YES, USE THAT INSTEAD >>B3AD
 B3A7  OTHERWISE, SAVE AUXID RECORD LEN (BE60)
 B3AD  ALLOCATE A NEW FILE BUFFER <A1F5>
 B3B0  ERROR? >>B349
 B3B2  GET BUFFER PAGE NO. (BC88)
 B3B5  AND STORE IN OPEN LIST (BECF)
 B3BA  LEVEL = 7 (BF94)
 B3BF  MLI: OPEN <BE70>
 B3C2  NO ERRORS? >>B3CB

 B3C4  ---
 B3C5  ERROR, FREE BUFFER FIRST <A24C>
 B3CA  THEN EXIT WITH ERROR CODE

 B3CB  CHECK FILE TYPE AGAIN (BEB8)
 B3CE  "DIR" FILE?
 B3D0  YES >>B3D3
 B3D2  NO
 B3D3  ---
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B3D6
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

 B3D6  SET DIR FLAG ACCORDINGLY (BE47)
 B3D9  USING OPEN COUNT AS AN INDEX (BE4D)
 B3DF  STORE BUFFER LOCATION IN OPEN FILE LIST (BC94)
 B3E5  ALSO, THE REFNUM (BC9C)
 B3E8  AND BUMP OPEN FILE COUNT AND FALL THRU (BE4D)

B3EB ********** SAVE FILE NAME/RECLEN IN TABLE **********************

 B3EB  MAKE INDEX FROM REFNUM*32 BYTES
 B3F1  GET NAME LENGTH (0280)
 B3F4  OR IN DIR FLAG (BE47)
 B3F7  AND STORE IN OPEN FILE NAME LIST (BCFE)
 B3FD  NAME > OR = TO 30 BYTES?
 B3FF  NO... >>B403
 B401  YES, USE 29
 B403  STORE THAT AS A LOOP COUNTER
 B408  COPY "L" KEYWORD VALUE TO NAME LIST TOO (BCFF)
 B411  ---
 B412  COPY FILE NAME TO NAME LIST (0280)
 B41B  COPY ALL OF NAME, THEN FALL THRU TO EXIT >>B411

B41D ********** "MON" AND "NOMON" COMMANDS **************************

 B41D  IGNORE THESE COMMANDS AND
 B41E  RETURN TO CALLER

B41F ********** LOOKUP OPEN FILENAME ********************************
        (RETURNS REFNUM OF OPEN FILE)

 B41F  ---
 B422  WAS PATHNAME1 GIVEN?
 B424  YES >>B42A

 B426  NO, "SYNTAX ERROR"
 B429  EXIT WITH ERROR

 B42A  ANY FILES CURRENTLY OPEN? (BE4D)
 B42D  NO, CAN'T FIND IT THEN >>B448
 B42F  YES, CLEAR EXEC FILE CLOSING FLAG (BE4E)
 B432  STORE FILE COUNT AS LOOP COUNTER
 B434  GET NEXT REFNUM (BC9B)
 B437  COMPARE FILENAMES <B462>
 B43A  NOT THE ONE? >>B443
 B43C  ELSE, WE'VE GOT IT!
 B43E  PICK UP APPROPRIATE REFNUM (BC9B)
 B441  ---
 B442  AND RETURN WITH IT
 B443  ELSE, NOT IT, TRY NEXT ONE
 B446  AND CONTINUE LOOPING >>B432
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B446
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  B448  CAN'T FIND IT, IS EXEC ACTIVE? (BE43)
  B44B  NO, THEN WE MUST GIVE UP >>B45E
  B450  IS HE LOOKING FOR EXEC FILE? <B462>
  B453  NO, GIVE UP >>B45E
  B457  YES, EXEC FILE CLOSING (BE4E)
  B45C  AND RETURN WITH EXEC'S REFNUM >>B43E

  B45E  "FILE NOT OPEN" ERROR
  B461  RETURN WITH ERROR CODE

B462 ********** COMPARE FILENAMES **********************************

  B462  REFNUM*32 FOR FILENAME INDEX
  B468  PICK UP DIR FLAG FROM THIS ENTRY (BCFE)
  B470  SAME LENGTH AS HIS FILENAME? (0280)
  B473  NO, CAN'T BE IT THEN >>B498
  B476  MAKE SURE LENGTH DOES NOT EXCEED 29
  B47A  IF IT DOES, ONLY LOOK AT FIRST 29
  B47C  USE $3A AS LOOP COUNTER
  B481  COPY "L" OF THIS FILE TO KEYWORD (BCA4)
  B48A  ---
  B48B  COMPARE NAMES (0280)
  B491  NO MATCH? EXIT WITH Z FLAG CLEAR >>B498
  B498  MATCH, EXIT WITH Z FLAG SET

B499 ********** "CLOSE" COMMAND ************************************

  B499  ---
  B49C  PATHNAME1 GIVEN?
  B49E  NO, CLOSE ALL FILES >>B4F2
  B4A0  YES, LOOK IT UP IN OPEN FILE TABLES <B41F>
  B4A3  NOT FOUND? >>B441
  B4A5  FOUND IT, STORE REFNUM IN CLOSE LIST (BEDE)
  B4AB  MARK BUFFER PAGE FREE (BC88)
  B4AE  EXEC CLOSING? (BE4E)
  B4B1  YES...NO NEED TO COMPRESS LISTS >>B4CF
  B4B3  GET OPEN COUNT (LAST OPENED FILE NO.) (BE4D)
  B4B7  SWAP BUFFERS (BC93)
  B4C5  AND REFNUMS WITH THE LAST OPENED FILE (BC9B)
  B4CF  ---
  B4D1  LEVEL = 0 (BF94)
  B4D6  MLI: CLOSE <BE70>
  B4D9  ERROR? >>B502
  B4DB  RELEASE THE BUFFER <A24C>
  B4DE  EXEC FILE CLOSING? (BE4E)
  B4E1  NO >>B4EE
  B4E6  YES, EXEC NO LONGER ACTIVE (BE43)
  B4E9  AND NO LONGER CLOSING (BE4E)
  B4ED  RETURN TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B4ED
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  B4EE  DROP OPEN FILE COUNT  (BE4D)
  B4F1  AND EXIT

B4F2 ********** CLOSE ALL OPEN FILES ********************************

  B4F2  ANY FILES OPEN? (BE4D)
  B4F5  NO >>B503
  B4F7  YES, EXEC NOT CLOSING (BE4E)
  B4FD  CLOSE LAST FILE OPENED <B4A5>
  B500  IF THAT WORKS, START ALL OVER AGAIN >>B4F2
  B502  EXIT WHEN ALL ARE CLOSED

  B503  ---
  B505  SET CLOSE REFNUM TO ZERO (ALL FILES) (BEDE)
  B50A  LEVEL = 7 (LEVEL 0 FILES ALREADY CLOSED) (BF94)
  B50F  EXIT THRU MLI: CLOSE >>BE70

B512 ********** "POSITION" COMMAND **********************************

  B512  LOOKUP NAME OF FILE <B41F>
  B515  NOT OPEN? >>B57F
  B517  SET REFNUM IN READ/WRITE PARMLIST (BED6)
  B51A  AND SET NEWLINE LIST (BED2)
  B51D  DIR FILE? (BE47)
  B520  YES, GET OUT RIGHT NOW! >>B580

  B522  "F" OR "R" GIVEN? (BE57)
  B527  NO, INVALID PARM >>B57D
  B529  BOTH GIVEN?
  B52B  YES, INVALID PARM >>B57D
  B52D  JUST "R" GIVEN?
  B52F  NO, JUST "F" >>B53D
  B531  JUST "R", COPY "R" VALUE TO "F" (BE65)
  B534  ("R" AND "F" ARE ALIASES) (BE63)
  B53D  SET COUNT TO 239. (MAXIMUM LINE LEN)
  B54C  BUFFER IS AT $200 (BED8)
  B54F  ---
  B551  NEW LINE CHAR IS EITHER $0D OR $8D (BED3)
  B556  MLI: SET NEWLINE <BE70>
  B559  ERROR? >>B57F

        ******** SKIP LINES BY READING THEM *****

  B55B  ---
  B55E  "F" = 0? (BE64)
  B562  YES, DONE >>B580
  B564  ELSE...
  B566  MLI: READ NEXT FIELD (LINE)  <BE70>
  B569  ERROR? >>B57F
  B56E  DECREMENT "F" VALUE BY ONE
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B57B
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

  B57B  AND GO CHECK IT AGAIN >>B55B

  B57D  "INVALID PARAMETER" ERROR
  B57F  ---
  B580  EXIT TO CALLER

B581 *********** COMPUTE NEW FILE POSITION ***************************
         (COMPUTES ABSOLUTE FILE POSITION MARK)

  B581  ACCUM = CURRENT RECORD LENGTH (BCA4)
  B595  MARK = 0 (BEC8)

          ******** MARK = "R" * RECLEN ************

  B59E  SHIFT "R" VALUE RIGHT (BE66)
  B5A6  IF LOW BIT OFF, NO ADD >>B5BF
  B5A9  ADD ONE INSTANCE OF RECLEN TO MARK (BCAF)
  B5B8  OVERFLOW? >>B5D2
  B5BD  ACCUM OVERFLOW? >>B5D2
  B5BF  SCALE ACCUM (MULTIPLIER) UP BY 2 (BCAF)
  B5C8  IF "R" NON ZERO... (BE65)
  B5CE  CONTINUE LOOPING >>B59E
  B5D1  ELSE, EXIT TO CALLER

  B5D2  "RANGE ERROR"
  B5D5  RETURN

B5D6 *********** "READ" COMMAND ***************************************

  B5D6  LOOK UP FILE NAME <B41F>
  B5D9  NOT OPEN? >>B62B
  B5DB  ITS OPEN, STORE REFNUM IN READ/WRITE... (BED6)
  B5DE  GET/SET... (BEC7)
  B5E1  AND SET NEWLINE PARMLISTS (BED2)
  B5E4  DIR FILE? (BE47)
  B5E7  YES, SPECIAL HANDLING REQUIRED >>B62C
  B5E9  NO, PRE-POSITION FOR "B", "F", OR "R" <B666>
  B5EC  ERROR POSITIONING? >>B62B
  B5EE  ASSUME "L" = 239.
  B5F5  "L" GIVEN?
  B5F7  NO >>B60C
  B5F9  YES, USE HIS "L" VALUE (BE5F)
  B5FF  UNLESS ITS >256 >>B661
  B603  OR >239. >>B661
  B607  DOUBLE QOUTE IT SO COMMAS COME THRU (0200)
  B60A  READ INTO $201
  B60C  IF NO "L", READ TO $200 (BED7)
  B612  NL CHAR = $0D/$8D (OR NONE IF "L") (BED3)
  B621  MLI: SET NEWLINE <BE70>
  B624  ERROR? >>B62B
  B626  ---
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B628
-----------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------

  B628  MARK INPUT "READ" FILE ACTIVE (BE44)
  B62B  AND RETURN

          ******** READ DIR FILE ******************

  B62C  SET READ/WRITE LIST REFNUM (BED6)
  B62F  AND GET/SET LIST REFNUM (BEC7)
  B634  READING TO $259 (BED7)
  B63E  INIT CAT FLAG TO FIRST LINE VALUE (BE4F)
  B644  "R" GIVEN?
  B647  NO, DONE >>B626
  B64B  YES, ZERO OUT MARK (BEC8)
  B656  MLI: REWIND FILE <BE70>
  B659  ERROR? >>B660
  B65D  MARK INPUT FILE ACTIVE  (BE44)
  B660  AND EXIT

B661 *********** "RANGE ERROR" ****************************************

  B661  "RANGE ERROR" CODE
  B665  EXIT TO CALLER

B666 *********** PRE-POSITION FOR I/O *********************************

  B666  ---
  B669  "B", "F", OR "R" GIVEN?
  B66B  NO, EXIT >>B6AF
  B66D  "R"?
  B66F  NO >>B67B
  B671  YES, COMPUTE ABSOLUTE POSITION <B581>
  B674  ERROR? >>B661
  B676  NO, SET MARK TO NEW POSITION <B6A8>
  B679  ERROR? >>B6B0
  B67B  "F" GIVEN? (BE57)
  B680  NO >>B687
  B682  SKIP LINES UNTIL "F" = 0 <B53D>
  B685  ERROR? >>B6B0
  B687  "B" GIVEN? (BE57)
  B68C  NO >>B6AF
  B690  MLI: GET MARK <BE70>
  B693  ERROR? >>B6B0
  B699  ADD "B" VALUE TO CURRENT MARK (BE5A)
  B69C  (3 BYTE ADD) (BEC8)
  B6A6  OVERFLOW? >>B661
  B6A8  ---
  B6AA  MLI: SET MARK <BE70>
  B6AD  ERROR? >>B6B0
  B6AF  ---
  B6B0  ---
  B6B2  EXIT TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B6B2
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

B6B3 *********** "WRITE" COMMAND ************************************

  B6B3  LOOKUP OPEN FILE NAME <B41F>
  B6B6  NOT AN OPEN FILE? >>B6C8
  B6B8  STORE READ/WRITE REFNUM (BED6)
  B6BB  AND GET/SET REFNUM (BEC7)
  B6BE  AND NEWLINE REFNUM IN PARM LISTS (BED2)
  B6C1  DIR FILE? (BE47)
  B6C4  NO, OK >>B6CA

  B6C6  YES, "FILE LOCKED" ERROR
  B6C8  ---
  B6C9  EXIT TO CALLER

  B6CA  DATA BUFFER AT $200
  B6D4  PRE-POSITION FOR "B", "F", AND "R" <B666>
  B6D7  NO ERRORS? >>B6ED
  B6D9  WAS ERROR A RANGE ERROR?
  B6DB  NO, REAL ERROR >>B6C8
  B6DD  YES, MY RANGE ERROR OR MLI'S?
  B6DF  MINE... >>B6C8
  B6E1  MLI'S...SET EOF FARTHER INTO FILE
  B6E3  MLI: SET EOF <BE70>
  B6E6  ERROR? >>B6C8
  B6E8  AND THEN TRY AGAIN TO SET MARK <B676>
  B6EB  ERROR? THEN I GIVE UP >>B6C8
  B6ED  BUFFER IS AT HIMEM
  B6F9  INDICATE OUTPUT "WRITE" FILE ACTIVE (BE45)
  B6FD  RETURN TO CALLER

B6FE *********** "APPEND" COMMAND ***********************************

  B6FE  ---
  B6FF  LOOK UP NAME IN OPEN FILE LIST <B41F>
  B702  FOUND IT? >>B710
  B705  NO, OPEN IT FIRST <B338>
  B708  ERROR? >>B71E
  B70A  NO, REFNUM NON-ZERO? (BED0)
  B70D  YES, OK >>B711
  B70F  ELSE, BREAK!!!
  B710  ---
  B711  REFNUM TO READ/WRITE PARM LIST (BED6)
  B714  AND GET/SET LIST (BEC7)
  B717  DIR FILE? (BE47)
  B71A  NO >>B720
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B71A
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  B71C  YES, "FILE LOCKED"
  B71E  ---
  B71F  EXIT TO CALLER

  B720  PICK UP "L" VALUE (BE5F)
  B729  DID USER SPECIFY ONE?
  B72B  YES... >>B733
  B72D  NO, USE FILE'S CURRENT "L" VALUE (BEB9)
  B733  ---
  B738  COMPUTE REFNUM*32 FOR INDEX INTO
  B739  FILE NAME TABLE
  B73E  SAVE CURRENT "L" VALUE IN OPEN FILE (BCFF)
  B741  NAME TABLE AND IN CURRENT RECLEN (BCA4)
  B74D  MLI: GET EOF <BE70>
  B750  ERROR? >>B71E
  B752  IS "L" VALUE < 2? (NO SPECIFIC "L") (BCA5)
  B755  NO >>B75E
  B75C  YES >>B763
  B75E  NO, FORCE TO RECORD BOUNDARY <B766>
  B761  ERROR? >>B71E
  B763  ELSE, GO SET EOF=MARK/OUTPUT FILE ACTIVE >>B6E1

B766 *********** FORCE TO EVEN RECORD BOUNDARY ************************
        (FIND RECORD NUMBER OF THIS POSITION)

  B766  ---
  B768  COPY EOF TO ACCUM (BEC7)
  B771  CLEAR MSB'S (BCB2)
  B777  GET READY FOR A 24 BIT DIVIDE
  B779  DIVIDE EOF BY... <AAD7>
  B786  RECORD LENGTH (BCA4)
  B79B  ---
  B7A1  WAS THERE A REMAINDER? (BCB3)
  B7A5  NO, OK... >>B7CF
  B7AB  YES, CURRENT RECORD LEN LESS REMAINDER (BCB2)
  B7B8  PLUS OLD EOF MARK (BEC8)
  B7C2  GIVES NEW EOF ON AN EVEN RECORD BOUNDARY (BEC9)
  B7CD  "RANGE ERROR" POSSIBLE IF OVERFLOW OCCURS
  B7CF  RETURN TO CALLER

B7D0 *********** GET FILE INFO ***************************************

  B7D0  SET NUMBER OF PARMS (10)
  B7D5  MLI CODE FOR GET FILE INFO
  B7D7  GO DO IT >>B7EE
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B7D7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

B7D9 *********** SET FILE INFO ***************************************

  B7D9  MODIFIED TIME/DATE = Ø
  B7E7  SET NUMBER OF PARMS (7)
  B7EC  MLI CODE FOR SET FILE INFO
  B7EE  EXIT THRU MLI: GET/SET FILE INFO >>BE7Ø

B7F1 *********** BI I/O INDIRECTION VECTORS **************************

  B7F1  DOSOUT VECTOR >>BE38
  B7F4  DOSIN VECTOR >>BE3A

B7F7 *********** STATE I/O VECTORS TABLE *****************************

  B7F7  IMMEDIATE MODE (STATE=Ø) CSWL/KSWL
  B7FB  DEFERRED MODE (STATE=4) CSWL/KSWL
  B7FF                (STATE=8) CSWL/KSWL
  B8Ø3                (STATE=C) CSWL

B8Ø5 *********** SYSCTBL *********************************************
         LSB'S OF MLI CALL PARAMETER LISTS IN THE
         BI GLOBAL PAGE ($BEXX)

  B8Ø5  CREATE: $AØ  DESTROY: $AC  RENAME: $AF
  B8Ø8  SFI:    $B4  GFI:     $B4  ONLINE: $C6
  B8ØB  SPFX:   $AC  GPFX:    $AC  OPEN:   $CB
  B8ØE  NEWLINE:$D1  READ:    $D5  WRITE:  $D5
  B811  CLOSE:  $DD  FLUSH:   $DD  SMARK:  $C6
  B814  GMARK:  $C6  SEOF:    $C6  GEOF:   $C6
  B817  SBUF:   $C6  GBUF:    $C6

B819 *********** APPLESOFT TOKENS ************************************
         TOKENS REQUIRING SPECIAL ATTENTION HAVE
         THEIR MSB OFF AND ARE AN OFFSET FROM A
         JMP IN THE TRACE HANDLER IN THE BI

  B819  FIRST IS $8Ø (END)
  B823   CALL
  B833   TRACE, NOTRACE, NORMAL
  B837   INVERSE, FLASH
  B83F   RESUME
  B843   LET, IF
  B853   PRINT, LIST

B859 *********** COMMAND NAME TABLES *********************************
         OFFSETS TO LAST CHARACTER OF EACH COMMAND
         NAME IN THE COMMAND NAME TABLE BELOW.
         COMMANDS ARE ARRANGED ACCORDING TO LENGTH
         WITH THREE BYTE NAMES FIRST.  IF THE MSB
         OF AN INDEX IS ON, THEN THIS IS THE LAST
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B859
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------
         NAME OF THE GIVEN LENGTH (NEXT WILL BE
         ONE BYTE LONGER).

  B859  Ø1 IN#       Ø2 PR#       Ø3 CAT
  B85C  Ø4 FRE       Ø5 BYE       Ø6 RUN
  B85F  Ø7 BRUN      Ø8 EXEC      Ø9 LOAD
  B862  ØA LOCK      ØB OPEN      ØC READ
  B865  ØD SAVE      ØE BLOAD     ØF BSAVE
  B868  1Ø CHAIN     11 CLOSE     12 FLUSH
  B86B  13 NOMON     14 STORE     15 WRITE
  B86E  16 APPEND    17 CREATE    18 DELETE
  B871  19 PREFIX    1A RENAME    1B UNLOCK
  B874  1C VERIFY    1D CATALOG   1E RESTORE
  B877  1F POSITION

  B878  'BSAVERIFYBLOADELETEBYECATALOGOPE'
  B898  'NWRITEXECREATEFRESTORENAMEBRUNLO'
  B8B8  'CKCHAIN#FLUSHREADPOSITIONOMONPR#'
  B8D8  'PREFIXCLOSEAPPEND'

B8E9 *********** COMMAND HANDLER ADDRESS TABLE ***********************
         ADDRESSES OF THE COMMAND HANDLER ROUTINES
         FOR EACH COMMAND IN THE ORDER GIVEN ABOVE.

  B8E9  (EXTERNAL)
  B8EB  IN#
  B8ED  PR#
  B8EF  CAT
  B8F1  FRE
  B8F3  BYE
  B8F5  RUN
  B8F7  BRUN
  B8F9  EXEC
  B8FB  LOAD
  B8FD  LOCK
  B8FF  OPEN
  B9Ø1  READ
  B9Ø3  SAVE
  B9Ø5  BLOAD
  B9Ø7  BSAVE
  B9Ø9  CHAIN
  B9ØB  CLOSE
  B9ØD  FLUSH
  B9ØF  NOMON
  B911  STORE
  B913  WRITE
  B915  APPEND
  B917  CREATE
  B919  DELETE
  B91B  PREFIX
  B91D  RENAME
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B91F
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B91F  UNLOCK
  B921  VERIFY
  B923  CATALOG
  B925  RESTORE
  B927  POSITION
  B929  "-" COMMAND

B92B ********** PERMITTED KEYWORDS FOR CMDS *************************
         TWO BYTES PER COMMAND IN THE ORDER ABOVE.
         EACH ENTRY HAS 16 BIT SETTINGS FOR THE
         PARAMETERS PERMITTED ON THAT COMMAND.
         8000 = FETCH PREFIX, PATHNAME OPTIONAL
         4000 = SLOT (FOR PR# OR IN#)
         2000 = DEFERRED COMMAND ONLY
         1000 = FILENAME IS OPTIONAL
         0800 = IF FILE NOT FOUND, CREATE IT
         0400 = "T" (FILE TYPE) PERMITTED
         0200 = PATHNAME2 (RENAME) PERMITTED
         0100 = PATHNAME1 EXPECTED
         0080 = "A" (ADDRESS) PERMITTED
         0040 = "B" (BYTE) PERMITTED
         0020 = "E" (END ADDRESS) PERMITTED
         0010 = "L" (LENGTH) PERMITTED
         0008 = "@" (LINE NO.) PERMITTED
         0004 = "S" AND/OR "D" (SLOT/DRIVE)
         0002 = "F" (FIELD) PERMITTED
         0001 = "R" (RECORD) PERMITTED
         ("V" IS IGNORED)

        C         P S D F N T P P A B E L @ S F R
        O         F L E N E | A A | | | | | / | |
        M         X O F O W | T T | | | | | D | |
        M         | T E P F | H H | | | | | | | |
        N         | | R T I | 2 1 | | | | | | | |
        D         | | | | L | | | | | | | | | | |

  B92B  IN#       . X . . . . . . X . . . . . . .
  B92D  PR#       . X . . . . . . X . . . . . . .
  B92F  CAT       X . . X . . . X . . . . . X . .
  B931  FRE       . . . . . . . . . . . . . . . .
  B933  BYE       . . . . . . . . . . . . . . . .
  B935  RUN       . . . X . . . X . . . . X X . .
  B937  BRUN      . . . . . . . X X X X X . X . .
  B939  EXEC      . . . . . . . X . . . . . X X X
  B93B  LOAD      . . . . . . . X . . . . . X . .
  B93D  LOCK      . . . . . . . X . . . . . X . .
  B93F  OPEN      . . X . X X . X . . . X . X . .
  B941  READ      . . X . . . . X . X . X . X X X
  B943  SAVE      . . . . X . . X . . . . . X . .
  B945  BLOAD     . . . . . X . X X X X X . X . .
  B947  BSAVE     . . . . X X . X X X X X . X . .
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B949
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B949  CHAIN     . . . . . . . X . . . . X X . .
  B94B  CLOSE     . . . . . . . X . . . . . . . .
  B94D  FLUSH     . . . . . . . X . . . . . . . .
  B94F  NOMON     . . . . . . . . . . . . . . . .
  B951  STORE     . . . . X . . X . . . . . X . .
  B953  WRITE     . . X . . . . X . X . . . . X X
  B955  APPEND    . . X . X X . X . . . X . X . .
  B957  CREATE    . . . . X X . X . . . . . X . .
  B959  DELETE    . . . . . . . X . . . . . X . .
  B95B  PREFIX    X . . X . . . X . . . . . X . .
  B95D  RENAME    . . . . . . X X . . . . . X . .
  B95F  UNLOCK    . . . . . . . X . . . . . X . .
  B961  VERIFY    . . . X . . . X . . . . . X . .
  B963  CATALOG   X . . X . X . X . . . . . X . .
  B965  RESTORE   . . . . . . . X . . . . . X . .
  B967  POSITION  . . X . . . . X . . . . . . X X
  B969  "-"       . . . . . . . X . . . . . X . .

B96B ********** KEYWORD NAME TABLE ***********************************

  B96B  'ABELSDFRV@'

B975 ********** KEYWORD BIT POSITION TABLE **************************
         BIT POSITIONS IN PERMITTED PARMS TABLE
         FOR EACH KEYWORD IN THE ORDER GIVEN IN
         NAME TABLE.  "V" IS 00 (NOT USED)

  B975  ---

B97F ********** KEYWORD SIZE/OFFSET TABLE ***************************
         LOW 2 BITS - SIZE-1 OF VALUE IN BYTES
         HIGH 6 BITS- OFFSET TO LAST BYTE OF VALUE
                      FROM $BE58

  B97F  A: 2 BYTES AT +1
  B980  B: 3 BYTES AT +4
  B981  E: 2 BYTES AT +6
  B982  L: 2 BYTES AT +8
  B983  S: 1 BYTE  AT +9
  B984  D: 1 BYTE  AT +A
  B985  F: 2 BYTES AT +C
  B986  R: 2 BYTES AT +E
  B987  V: 1 BYTE  AT +10  (IGNORED)
  B988  @: 2 BYTES AT +11

B989 ********** FILE TYPES TABLES ************************************
         FILE TYPE CODES, GIVEN IN INVERSE ORDER
         TO FILE TYPE NAMES WHICH FOLLOW.
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: B989
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B989  $FF = "SYS"
  B98A  $FE = "REL"
  B98B  $FD = "VAR"
  B98C  $FC = "BAS"
  B98D  $FB = "IVR"
  B98E  $FA = "INT"
  B98F  $FØ = "CMD"
  B99Ø  $ØF = "DIR"
  B991  $Ø6 = "BIN"
  B992  $Ø4 = "TXT"
  B993  $EF = "PAS"
  B994  $1A = "AWP"
  B995  $1B = "ASP"
  B996  $19 = "ADB"

  B997  ---
  B997  'ADBASPAWPPASTXTBINDIRCMDINTIVRBASVARRELSYS'

B9C1 *********** MONTH TABLE ***************************************

  B9C1  'JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC'
  B9E5  '<NO DATE>'

B9EE *********** MLIERTBL ******************************************
         MLI ERROR CODES WHICH HAVE BI EQUIVALENTS

  B9EE  ---

BAØ1 *********** BIERTBL *******************************************
         BI EQUIVALENTS TO MLI ERROR CODES ABOVE
         (IF MLI CODE NOT FOUND, MAPS TO LAST CODE
         IN THIS TABLE, $Ø8 "I/O ERRROR")

  BAØ1  ---

BA15 *********** INDEXS TO PACKED MESSAGES ***************************
         BY BI ERROR NUMBER

  BA15  ---

BA29 *********** COMMON LETTERS IN MESSAGES ***************************

  BA29  ---
  BA29  'ACDEFILMNORTU '
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: BA38
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

BA38 *********** LESS COMMON LETTERS *********************************

  BA38  ---
  BA39  'BGHKPSVWXY/().:'

BA48 *********** PACKED MESSAGES *************************************

  BA48   "COPYRIGHT APPLE COMPUTER"

  BA58  " NAME "
  BA5B  TAB($1Ø)
  BA5D  "TYPE  BLOCKS "
  BA66  TAB($1E)
  BA68  "MODIFIED"
  BA6C  TAB($2F)
  BA6E  "CREATED "
  BA72  TAB($4Ø)
  BA74  "ENDFILE SUBTYPE"

  BA7E  "BLOCKS FREE:"
  BA86  TAB($16)
  BA88  "BLOCKS USED:"
  BA91  TAB($2C)
  BA93  "TOTAL BLOCKS:"

  BA9C  "RANGE ERROR"                  ERROR=$2

  BAA3  "NO DEVICE CONNECTED"          ERROR=$3

  BAAE  "WRITE PROTECTED"              ERROR=$4

  BAB7  "END OF DATA"                  ERROR=$5

  BABD  "PATH NOT FOUND"             ERROR=$6,$7
  BACØ

  BAC6  "I/O ERROR"                    ERROR=$8

  BACC  "DISK FULL"                    ERROR=$9

  BAD2  "FILE LOCKED"                  ERROR=$A

  BAD9  "INVALID PARAMETER"            ERROR=$B

  BAE3  "RAM TOO LARGE"                ERROR=$C

  BAFØ  "FILE TYPE MISMATCH"           ERROR=$D
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: BAF8
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  BAFC  "PROGRAM TOO LARGE"             ERROR=$E

  BB07  "NOT DIRECT COMMAND"            ERROR=$F

  BB11  "SYNTAX ERROR"                  ERROR=$10

  BB19  "DIRECTORY FULL"                ERROR=$11

  BB21  "FILE NOT OPEN"                 ERROR=$12

  BB29  "DUPLICATE FILE NAME"           ERROR=$13

  BB34  "FILE BUSY"                     ERROR=$14

  BB3B  "FILE(S) STILL OPEN"            ERROR=$15

BB47 *********** VARIABLES ****************************************

  BB47  NUMBER OF PAGES TO ALLOCATE/FREE
  BB48  NOT USED
  BB49  TOP OF BUFFERS FOR GARBAGE COLLECTION
  BB4A  BOTTOM OF BUFFERS

BB4B *********** $BB4B-$BC7A NOT USED *******************************

  BB4B  NOT USED

BC7B *********** VARIABLES ****************************************

  BC7B  SAVED HIMEM VALUE DURING CHAIN LOAD
          ******** GARBAGE COLLECT MARKED GC: ****
  BC7C  GC: HIRANGE - WORKSAREASIZE
  BC7D  GC: WORKAREA MSB
  BC7E  GC: NUMBER OF PAGES IN WORKAREA
  BC7F  GC: LORANGE (START OF STRINGS TO COPY)
  BC80  GC: HIRANGE (END OF STRINGS TO COPY)
  BC81  ARRAYS START LSB
  BC82  ARRAYS ENDING MSB+1
  BC83  GC: START OF STRING AREA (ALSO PGM START)
  BC85  GC: END OF STRING AREA
  BC87  MSB ADJUST FACTOR FOR STRING POINTERS
  BC88  PAGE FOLLOWING BLOCK BUFFER
          ******** STORED VARIABLES FILE HEADER ***
  BC89  COMBINED LEN OF SIMPLE/ARRAY VARS
  BC8B  LEN OF SIMPLE VARS ONLY
  BC8D  HIMEM WHEN VARS WERE COMBINED
          ************************************
  BC8E  POINTER TO COMBINED VARIABLES/STRINGS
  BC90  LENGTH OF COMBINED VARIABLES/STRINGS
  BC92  LENGTH OF STRINGS ONLY
```

```
BASIC Interpreter (BI) -- V1.1.1 -- 18 JUN 84   NEXT OBJECT ADDR: BC92
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  BC94  OPEN FILES' BUFFER MSBS
  BC9B  OPEN EXEC FILE BUFFER MSB

  BC9C  OPEN FILES' REFERENCE NUMBERS
  BCA3  OPEN EXEC FILE REFNUM

  BCA4  CURRENT RECORD LENGTH
  BCA6  NOT USED
  BCA9  CHARACTER TO FLUSH WHEN PARSING (BLANK)
  BCAA  MAXIMUM LENGTH TO PARSE
  BCAB  ADDRESS OF COMMAND HANDLING ROUTINE
  BCAD  SIZE OF KEYWORD VALUE -1 IN BYTES
  BCAE  OFFSET INTO KEYWORD PARMS TO LAST BYTE
  BCAF  GENERAL PURPOSE 4 BYTE ACCUMULATOR
  BCB3  MONTH
  BCB4  DAY
  BCB5  YEAR
  BCB6  ERROR MSG LEN OR LINE LEN FOR CAT/CATALOG
  BCB7  ENTRY LENGTH IN DIRECTORY FILE
  BCB8  ENTRIES PER BLOCK IN DIRECTORY FILE
  BCB9  FILE COUNT FROM DIRECTORY FILE
  BCBB  DIRECTORY ENTRY NUMBER COUNTER

BCBC *********** PATHNAME 1 BUFFER ************************************

  BCBC  COMMAND OR PATH LENGTH
  BCBD  TXBUF (COMMAND OR PATHNAME STRING)
  BCFD  NOT USED

BCFE *********** OPEN FILE NAME TABLE *********************************
          (EACH ENTRY IS 32 BYTES LONG)
          (THERE ARE 8 ENTRIES)

  BCFE  FILE 0: LENGTH OF NAME
  BCFF  FILE 0: L VALUE LSB
  BD00  FILE 0: L VALUE MSB
  BD01  FILE 0: START OF NAME STRING
          (FILE NAME IS STORED BACKWARDS)
  BDFE  LAST 2 BYTES NOT USED
```

BASIC INTERPRETER GLOBAL PAGE

This page of memory is rigidly defined by the ProDOS BI. Fields given here will not move in later versions of ProDOS and may be referenced by external, user-written programs. Future additions to the global page may be made in areas which are marked "Not used".

ProDOS BI Global Page NEXT OBJECT ADDRESS: BE00

ADDR	LABEL	CONTENTS
BE00-BE02	BI.ENTRY	JMP to WARMDOS (BI warmstart vector).
BE03-BE05	DOSCMD	JMP to SYNTAX (BI command line parse and execute).
BE06-BE08	EXTRNCMD	JMP to user-installed external command parser.
BE09-BE0B	ERROUT	JMP to BI error handler.
BE0C-BE0E	PRINTERR	JMP to BI error message print routine. Place error number in A-register.
BE0F	ERRCODE	ProDOS error code (also at $DE, Applesoft ONERR code).
BE10-BE1F	OUTVEC	Default output vector in monitor and for each slot (1-7).
BE20-BE2F	INVEC	Default input vector in monitor for each slot (1-7).
BE30-BE31	VECTOUT	Current output vector.
BE32-BE33	VECTIN	Current input vector.
BE34-BE35	VDOSIO	BI's output intercept address.
BE36-BE37		BI's input intercept address.
BE38-BE3B	VSYSIO	BI's internal redirection by STATE.
BE3C	DEFSLT	Default slot.
BE3D	DEFDRV	Default drive.
BE3E	PREGA	A-register savearea.
BE3F	PREGX	X-register savearea.
BE40	PREGY	Y-register savearea.
BE41	DTRACE	Applesoft TRACE is enabled flag (MSB on).
BE42	STATE	Current intercept state. 0 = immediate command mode. >0 = deferred.
BE43	EXACTV	EXEC file active flag (MSB on).
BE44	IFILACTV	READ file active flag (MSB on).
BE45	OFILACTV	WRITE file active flag (MSB on).
BE46	PFXACTV	PREFIX read active flag (MSB on).
BE47	DIRFLG	File being READ is a DIR file (MSB on).
BE48	EDIRFLG	End of directory flag (no longer used).
BE49	STRINGS	String space count used to determine when to garbage collect.
BE4A	TBUFPTR	Buffered WRITE data length.
BE4B	INPTR	Command line assembly length.
BE4C	CHRLAST	Previous output character (for recursion check).
BE4D	OPENCNT	Number of files open (not counting EXEC).
BE4E	YXFILE	EXEC file being closed flag (MSB on).
BE4F	CATFLAG	Line type to format next in DIR file READ.
BE50-BE51	XTRNADDR	External command handler address.
BE52	XLEN	Length of command name (less one).

ProDOS BI Global Page NEXT OBJECT ADDRESS: BE53

ADDR	LABEL	CONTENTS
BE53	XCNUM	Number of command: $00 = external $0A = OPEN $14 = WRITE $01 = IN# $0B = READ $15 = APPEND $02 = PR# $0C = SAVE $16 = CREATE $03 = CAT $0D = BLOAD $17 = DELETE $04 = FRE $0E = BSAVE $18 = PREFIX $05 = RUN $0F = CHAIN $19 = RENAME $06 = BRUN $10 = CLOSE $1A = UNLOCK $07 = EXEC $11 = FLUSH $1B = VERIFY $08 = LOAD $12 = NOMON $1C = CATALOG $09 = SAVE $13 = STORE $1D = RESTORE $1E = POSITION
BE54-BE55	PBITS	Permitted command operands bits: $8000 Prefix needed. Pathname optional. $4000 Slot number only (PR# or IN#). $2000 Deferred command. $1000 File name optional. $0800 If file does not exist, create it. $0400 T: file type permitted. $0200 Second file name required. $0100 First file name required. $0080 AD: address keyword permitted. $0040 B: byte offset permitted. $0020 E: ending address permitted. $0010 L: length permitted. $0008 @: line number permitted. $0004 S or D: slot/drive permitted. $0002 F: field permitted. $0001 R: record permitted. (V always permitted but ignored.)
BE56-BE57	FBITS	Operands found on command line. Same bit assignments as above.
BE58-BE59	VADDR	A keyword value.
BE5A-BE5C	VBYTE	B keyword value.
BE5D-BE5E	VENDA	E keyword value.
BE5F-BE60	VLNTH	L keyword value.
BE61	VSLOT	S keyword value.
BE62	VDRIV	D keyword value.
BE63-BE64	VFELD	F keyword value.
BE65-BE66	VRECD	R keyword value.
BE67	VVOLM	V keyword value (ignored).
BE68-BE69	VLINE	@ keyword value.
BE6A	VTYPE	T keyword value (in hex).
BE6B	VIOSLT	PR# or IN# slot number value.

ProDOS BI Global Page NEXT OBJECT ADDRESS: BE6C

ADDR	LABEL	CONTENTS
BE6C-BE6D	VPATH1	Primary pathname buffer (address of length byte).
BE6E-BE6F	VPATH2	Secondary pathname buffer (address of length byte).
BE70-BE84	GOSYSTEM	Call the MLI using the parameter tables which follow.
BE85	SYSCALL	MLI call number for this call.
BE86-BE87	SYSPARM	Address of MLI parameter list for this call.
BE88-BE8A		Return from MLI call.
BE8B-BE9E	BADCALL	MLI error return: translate error code to BI error number.
BE9F	BISPARE1	Not used.
BEA0-BEAB	SCREATE	CREATE parameter list.
BEAC-BEAE	SSGPRFX	GET_PREFIX, SET_PREFIX, DESTROY parameter list.
BEAF-BEB3	SRENAME	RENAME parameter list.
BEB4-BEC5	SSGINFO	GET_FILE_INFO, SET_FILE_INFO parameter list.
BEC6-BECA	SONLINE	ONLINE, SET_MARK, GET_MARK, SET_EOF, GET_EOF, SET_BUF, GET_BUF, QUIT parameter list.
BECB-BED0	SOPEN	OPEN parameter list.
BED1-BED4	SNEWLN	SET_NEWLINE parameter list.
BED5-BEDC	SREAD	READ, WRITE parameter list.
BEDD-BEDE	SCLOSE	CLOSE, FLUSH parameter list.
BEDF-BEF4	CCCSPARE	"COPYRIGHT APPLE, 1983"
BEF5-BEF7	GETBUFR	GETBUFR buffer allocation subroutine vector.
BEF8-BEFA	FREEBUFR	FREEBUFR buffer free subroutine vector.
BEFB		Original HIMEM MSB.
BEFC-BEFF		Not used.

```
Disk Controller Boot ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C600
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

C600    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  BOOT ROM - APPLE DISK CONTROLLER    *
          *       FOR APPLE II, II+, AND IIe.    *
          *       THIS CODE RESIDES FROM $C600   *
          *       TO $C6FF, IT LOADS TRACK 0     *
          *       SECTOR 0 INTO RAM AT $800 AND  *
          *       JUMPS TO IT                    *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0026    SECTOR BUFFER POINTER
002B    SLOT NUMBER * 16 FOR INDEX
003C    WORKBYTE
003D    SECTOR WANTED
0040    TRACK FOUND
0041    TRACK WANTED

          ******** EXTERNAL ADDRESSES *************

0100    SYSTEM STACK
0300    AUXILIARY BUFFER
0356    TRANSLATE TABLE
0800    SECTORS TO LOAD
0801    ENTRY POINT
C080    PHASE0 OFF
C081    PHASE0 ON
C089    MOTOR ON
C08A    DRIVE SELECT
C08C    READ DATA REGISTER
C08E    SET READ MODE
FCA8    MONITOR WAIT ROUTINE
FF58    RTS

C600 *********** BUILD READ TRANSLATE TABLE **************************

  C600  SIGNATURE
  C602  INITIALIZE TABLE VALUE INDICATOR
  C606  STORE BIT PATTERN
  C609  SHIFT PATTERN LEFT ONE BIT
  C60A  ARE THERE ANY TWO ADJACENT BITS ON?
  C60C  NO, TRY ANOTHER PATTERN  >>C61E
  C60E  YES, TURN OFF RIGHTMOST OF EACH GROUP OF ZEROES
  C610  FLIP BITS, PAIR OF ZERO BITS NOW SINGLE ONE BIT
  C612  HIGH BIT ALWAYS ON/TURN OFF BIT WE MISSED BEFORE
  C614  --- >>C61E
  C616  SHIFT PATTERN RIGHT, MUST HAVE ONLY ONE BIT ON
```

```
Disk Controller Boot ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C617
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  C617  IF MORE THAN ONE BIT ON, TRY ANOTHER PATTERN  >>C614
  C619  FOUND ONE, GET TABLE VALUE
  C61A  AND STORE IT IN TABLE  (0356)
  C61D  INCREMENT TABLE VALUE INDICATOR
  C61E  GET NEXT BIT PATTERN, DONE YET
  C61F  NO, GO CHECK IT OUT  >>C606

C621 *********** DETERMINE SLOT, TURN DRIVE ON ***********************

  C621  CALL A KNOWN RTS  <FF58>
  C624  GET STACK POINTER
  C625  GET HIGH BYTE OF WHERE WE ARE  (0100)
  C628  TIMES 16 TO GET SLOT
  C62C  SAVE SLOT
  C62E  PUT IN X REG FOR INDEX
  C62F  INSURE READ MODE  (C08E)
  C635  SELECT DRIVE 1  (C08A)
  C638  TURN THE MOTOR ON  (C089)

C63B *********** RECALIBRATE DISK ARM *********************************

  C63B  PREPAIR TO STEP THE ARM 80 PHASES
  C63D  TURN A PHASE OFF  (C080)
  C640  PUT COUNTER IN ACCUMULATOR
  C641  CREATE A PHASE NUMBER (0-3)
  C643  DOUBLE IT FOR PROPER INDEX
  C644  COMBINE WITH SLOT FOR FINAL INDEX
  C646  PUT INDEX IN X REGISTER
  C647  TURN A PHASE ON  (C081)
  C64A  DELAY ABOUT 20 MICROSECONDS
  C64F  DECREMENT COUNTER
  C650  LOOP UNTIL ALL 80 ARE DONE  >>C63D

C652 *********** INITIALIZATION ***************************************

  C652  ---
  C654  SECTOR TO FIND -> $00
  C656  TRACK TO FIND -> $00
  C65A  MAIN BUFFER POINTER ($26) -> $0800
  C65C  CLEAR THE CARRY
  C65D  PUSH STATUS ON STACK

C65E *********** SEARCH FOR A VALID HEADER ****************************

  C65E  CHECK DATA REGISTER  (C08C)
  C661  LOOP UNTIL DATA IS VALID  >>C65E
  C663  IS IT A $D5?
  C665  NO, TRY AGAIN  >>C65E
  C667  YES, CHECK REGISTER AGAIN  (C08C)
  C66A  LOOP UNTIL VALID  >>C667
  C66C  IS IT AN $AA
```

```
Disk Controller Boot ROM -- Apple II/1I+/IIe    NEXT OBJECT ADDR: C66E
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  C66E  NO, SEE IF ITS A $D5  >>C663
  C670  YES, DELAY FOR REGISTER TO CLEAR
  C671  CHECK REGISTER  (C08C)
  C674  LOOP UNTIL VALID  >>C671
  C676  IS IT A $96
  C678  YES, WE FOUND AN ADDRESS HEADER  >>C683
  C67A  NO, HAVE WE FOUND ONE PREVIOUSLY?
  C67B  IF NOT, START OVER  >>C65C
  C67D  WAS IT AN $AD?
  C67F  YES, WE FOUND A DATA HEADER  >>C6A6
  C681  NO, START OVER  >>C65C

C683 *********** DECODE ADDRESS FIELD *********************************

  C683  INITIALIZE COUNTER
  C685  SAVE VALUE DECODED, WILL BE TRACK ON LAST PASS
  C687  READ DATA REGISTER  (C08C)
  C68A  LOOP UNTIL DATA VALID  >>C687
  C68C  SHIFT BITS INTO POSITION X1X1X1X1
  C68D  SAVE FOR LATER
  C68F  READ REGISTER FOR NEXT BYTE  (C08C)
  C692  LOOP UNTIL VALID  >>C68F
  C694  COMBINE WITH PREVIOUS 1X1X1X1X AND X1X1X1X1
  C696  DECREMENT COUNTER, DONE YET?
  C697  NO, DO ANOTHER  >>C685
  C699  KEEP THE STACK CLEAN
  C69A  IS THIS SECTOR WE WANT?
  C69C  NO, START OVER  >>C65C
  C69E  GET TRACK FOUND
  C6A0  IS IT TRACK WE WANT?
  C6A2  NO, START OVER  >>C65C
  C6A4  YES, INDICATE ADDRESS FOUND, GO LOOK FOR DATA FIELD  >>C65D

C6A6 *********** READ DATA FIELD ***********************************

  C6A6  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6A8  ---
  C6AA  READ DATA REGISTER  (C08C)
  C6AD  LOOP UNTIL VALID  >>C6AA
  C6AF  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6B4  DECREMENT OFFSET
  C6B5  STORE BYTE IN AUXILIARY BUFFER  (0300)
  C6B8  LOOP UNTIL BUFFER FULL  >>C6A8
  C6BA  INITIALIZE OFFSET (MAIN BUFFER)
  C6BC  READ DATA REGISTER  (C08C)
  C6BF  LOOP UNTIL VALID  >>C6BC
  C6C1  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6C6  STORE BYTE IN MAIN BUFFER
  C6C8  INCREMENT OFFSET
  C6C9  LOOP UNTIL BUFFER FULL  >>C6BA
  C6CB  READ DATA REGISTER  (C08C)
```

```
Disk Controller Boot ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C6CE
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  C6CE  LOOP UNTIL VALID  >>C6CB
  C6D0  IS CHECKSUM OKAY?  (02D6)
  C6D3  NO, START OVER  >>C65C

C6D5 *********** MERGE MAIN AND AUXILIARY BUFFERS**********************

  C6D5  INITIALIZE OFFSET (MAIN BUFFER)
  C6D7  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6D9  DECREMENT OFFSET (AUX BUFFER)
  C6DA  IF LESS THAN ZERO RESET IT  >>C6D7
  C6DC  GET BYTE FROM MAIN BUFFER
  C6E1  ROLL IN TWO BITS FROM AUXILIARY BUFFER
  C6E6  SAVE COMPLETED DATA BYTE
  C6E8  INCREMENT OFFSET (MAIN BUFFER)
  C6E9  LOOP UNTIL WHOLE BUFFER IS DONE  >>C6D9

C6EB *********** DETERMINE IF THERE IS MORE TO DO**********************

  C6EB  INCREMENT MAIN BUFFER POINTER
  C6ED  INCREMENT SECTOR NUMBER
  C6F1  IS THERE ANOTHER SECTOR TO LOAD?  (0800)
  C6F6  YES, GO DO IT  >>C6D3
  C6F8  NO, ENTER CODE WE JUST LOADED  >>0801

C6FB *********** UNUSED ***********************************************

  C6FB  5 BYTES AT END OF PAGE ARE UNUSED
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C552
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C552    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  BOOT ROM - APPLE //c CONTROLLER ROM *
          *       THIS CODE RESIDES FROM $C552   *
          *       TO $C6FF. IT LOADS TRACK 0     *
          *       SECTOR 0 INTO RAM AT $800 AND  *
          *       JUMPS TO IT.  IF BOOT FAILS IT *
          *       THEN TRIES TO BOOT SLOT 5,     *
          *       THE PROTOCOL CONVERTER.        *
          *                                      *
          *  THIS IS THE VERSION OF THE IIC ROM  *
          *    THAT SUPPORTS THE UNIDISK 3.5,    *
          *    26 JULY 85.                       *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0001    SLOT PAGE PUT HERE DURING AUTOBOOT
0005    RETRY COUNT (HIGH BYTE)
0026    SECTOR BUFFER POINTER
002B    SLOT NUMBER * 16 FOR INDEX
003C    WORKBYTE
003D    SECTOR WANTED
0040    TRACK FOUND
0041    TRACK WANTED
004F    DRIVE TO BOOT FROM

          ******** EXTERNAL ADDRESSES *************

0300    AUXILIARY BUFFER
0356    TRANSLATE TABLE
07DB    SCREEN LOCATION
0800    SECTORS TO LOAD
0801    ENTRY POINT
C080    PHASE0 OFF
C081    PHASE0 ON
C0B8    MOTOR OFF
C0B9    MOTOR ON
C08C    READ DATA REGISTER
C08E    SET READ MODE
C0EA    DRIVE SELECT
FCA8    MONITOR WAIT ROUTINE
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C552
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C552 ********** SLOT5 CODE ****************************************

          THE FOLLOWING TWO ROUTINES ARE IN THE $C500
          AREA BUT ARE USED BY THE $C600 LOGIC.

C552 ********** BOOTFAIL ******************************************
          COME HERE IF BOOT FAILS.  PUT MESSAGE ON
          SCREEN AND GO TO SLEEP FOREVER.

  C552  17 CHARACTERS IN MESSAGE
  C557  PUT AT BOTTOM OF SCREEN (07DB)
  C55D  THEN GO TO SLEEP >>C55D

  C55F  'Check Disk Drive'

C56F ********** SKIP OVER MISCELLANEOUS CODE ***********************

  C56F  SLOT 5 LOGIC IN HERE

C58E ********** BUILD READ TRANSLATE TABLE ***************************

  C58E  INITIALIZE BIT PATTERN
  C590  INITIALIZE TABLE VALUE INDICATOR
  C592  STORE BIT PATTERN
  C595  SHIFT PATTERN LEFT ONE BIT
  C596  ARE THERE ANY TWO ADJACENT BITS ON?
  C598  NO, TRY ANOTHER PATTERN  >>C5AA
  C59A  YES, TURN OFF RIGHTMOST OF EACH GROUP OF ZEROES
  C59C  FLIP BITS, PAIR OF ZERO BITS NOW SINGLE BIT, ETC
  C59E  HIGH BIT ALWAYS ON/TURN OFF BIT WE MISSED BEFORE
  C5A0  --- >>C5AA
  C5A2  SHIFT PATTERN RIGHT, MUST HAVE ONLY ONE BIT ON
  C5A3  IF MORE THAN ONE BIT ON, TRY ANOTHER PATTERN  >>C5A0
  C5A5  FOUND ONE, GET TABLE VALUE
  C5A6  AND STORE IT IN TABLE  (0356)
  C5A9  INCREMENT TABLE VALUE INDICATOR
  C5AA  GET NEXT BIT PATTERN, DONE YET?
  C5AB  NO, GO CHECK IT OUT  >>C592
  C5AD  MAIN BUFFER POINTER ($26) -> $0800
  C5B1  INITIALIZE RETRY COUNT (LOW BYTE)
  C5B3  RETURN TO CALLER

C5B4 ********** SKIP OVER MISCELLANEOUS CODE ***********************

  C5B4  SLOT 5 LOGIC IN HERE
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C5F5
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C5F5 *********** JUMP TO BOOTFAIL ***********************************

  C5F5  BRANCH TO BOOTFAIL >>C552

  C5F8  REMAINING 8 BYTES NOT USED BY DISK II >>C576

C600 *********** INITIALIZATION ***********************************

  C600  SIGNATURE
  C602  SET DRIVE -> 1
  C604  INITIALIZE RETRY COUNT (HIGH BYTE)

C608 *********** SELECT DRIVE AND TURN IT ON *************************

  C608  ---
  C60B  INITIALIZE SLOT (6)
  C60D  INITIALIZE DEVICE (1 OR 2)
  C60F  SAVE DRIVE NUMBER ON STACK
  C610  INSURE READ MODE  (C08E)
  C616  GET DRIVE NUMBER BACK
  C617  SELECT APPROPRIATE DRIVE  (C0EA)
  C61A  TURN MOTOR ON  (C089)

C61D *********** RECALIBRATE DISK ARM *********************************

  C61D  PREPAIR TO STEP THE ARM 80 PHASES
  C61F  TURN A PHASE OFF  (C080)
  C622  PUT COUNTER IN A REGISTER
  C623  CREATE A PHASE NUMBER (0-3)
  C625  DOUBLE IT FOR PROPER INDEX
  C626  COMBINE WITH SLOT FOR FINAL INDEX
  C628  PUT INDEX IN X REGISTER
  C629  TURN A PHASE ON  (C081)
  C62C  DELAY ABOUT 20 MICROSECONDS
  C631  DECREMENT COUNTER
  C632  LOOP UNTIL ALL 80 ARE DONE  >>C61F

C634 *********** INITIALIZATION ***********************************

  C634  ---
  C636  SECTOR TO FIND -> $00
  C638  TRACK TO FIND -> $00
  C63A  BUILD THE TRANSLATE TABLE  <C58E>

C63D *********** COUNT RETRIES AND INDICATE ERROR IF BOOT FAILS*******

  C63D  INITIALIZE RETRY COUNT
  C63F  CLEAR THE CARRY
  C640  PUSH STATUS ON STACK
  C641  KEEP STACK CLEAN
  C642  GET SLOT
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C644
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  C644  DECREMEMT RETRY COUNT, TRY AGAIN?
  C646  YES, GO DO IT  >>C656
  C648  NO, TURN DRIVE OFF  (C088)
  C64B  AUTO BOOT FROM SLOT6?
  C64F  NO, FAIL NOW >>C5F5
  C651  MAYBE SLOT 5 WILL TALK TO US >>C500
  C654  TWO BYTES NOT USED >>0002
  C656  ---
  C657  DECREMENT RETRY COUNT (LOW BYTE)
  C658  IF NOT ZERO, TRY AGAIN  >>C65E
  C65A  IF SO, GO DECREMENT RETRY COUNT (HIGH BYTE)  >>C641
  C65C  SPACE FILLER TO POSITION CODE BELOW  >>C63D

C65E *********** SEARCH FOR A VALID HEADER ***************************

  C65E  CHECK DATA REGISTER  (C08C)
  C661  LOOP UNTIL DATA IS VALID  >>C65E
  C663  1S IT A $D5?
  C665  NO, TRY AGAIN  >>C657
  C667  YES, CHECK REGISTER AGAIN   (C08C)
  C66A  LOOP UNTIL VALID  >>C667
  C66C  IS IT AN $AA
  C66E  NO, SEE IF ITS A $D5  >>C663
  C670  YES, DELAY FOR REGISTER TO CLEAR
  C671  CHECK REGISTER  (C08C)
  C674  LOOP UNTIL VALID  >>C671
  C676  IS IT A $96
  C678  YES, WE FOUND AN ADDRESS HEADER  >>C683
  C67A  NO, HAVE WE FOUND ONE PREVIOUSLY?
  C67B  IF NOT, START OVER  >>C63F
  C67D  WAS IT AN $AD?
  C67F  YES, WE FOUND A DATA HEADER  >>C6A6
  C681  NO, START OVER  >>C63F

C683 *********** DECODE ADDRESS FIELD *********************************

  C683  INITIALIZE COUNTER
  C685  SAVE VALUE DECODED, WILL BE TRACK ON LAST PASS
  C687  READ DATA REGISTER  (C08C)
  C68A  LOOP UNTIL DATA VALID  >>C687
  C68C  SHIFT BITS INTO POSITION X1X1X1X1
  C68D  SAVE FOR LATER
  C68F  READ REGISTER FOR NEXT BYTE  (C08C)
  C692  LOOP UNTIL VALID  >>C68F
  C694  COMBINE WITH PREVIOUS 1X1X1X1X AND X1X1X1X1
  C696  DECREMENT COUNTER, DONE YET?
  C697  NO, DO ANOTHER  >>C685
  C699  KEEP THE STACK CLEAN
  C69A  IS THIS SECTOR WE WANT?
  C69C  NO, START OVER  >>C63F
  C69E  GET TRACK FOUND
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C6A0
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  C6A0  IS IT TRACK WE WANT?
  C6A2  NO, START OVER  >>C63F
  C6A4  YES, INDICATE ADDRESS FOUND, GO LOOK FOR DATA FIELD  >>C642

C6A6 *********** READ DATA FIELD ***********************************

  C6A6  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6A8  ---
  C6AA  READ DATA REGISTER  (C08C)
  C6AD  LOOP UNTIL VALID  >>C6AA
  C6AF  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6B4  DECREMENT OFFSET
  C6B5  STORE BYTE IN AUXILIARY BUFFER  (0300)
  C6B8  LOOP UNTIL BUFFER FULL  >>C6A8
  C6BA  INITIALIZE OFFSET (MAIN BUFFER)
  C6BC  READ DATA REGISTER  (C08C)
  C6BF  LOOP UNTIL VALID  >>C6BC
  C6C1  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6C6  STORE BYTE IN MAIN BUFFER
  C6C8  INCREMENT OFFSET
  C6C9  LOOP UNTIL BUFFER FULL  >>C6BA
  C6CB  READ DATA REGISTER  (C08C)
  C6CE  LOOP UNTIL VALID  >>C6CB
  C6D0  IS CHECKSUM OKAY?  (02D6)
  C6D3  NO, START OVER  >>C6A2

C6D5 *********** MERGE MAIN AND AUXILIARY BUFFERS**********************

  C6D5  INITIALIZE OFFSET (MAIN BUFFER)
  C6D7  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6D9  DECREMENT OFFSET (AUX BUFFER)
  C6DA  IF LESS THAN ZERO RESET IT  >>C6D7
  C6DC  GET BYTE FROM MAIN BUFFER
  C6E1  ROLL IN TWO BITS FROM AUXILIARY BUFFER
  C6E6  SAVE COMPLETED DATA BYTE
  C6E8  INCREMENT OFFSET (MAIN BUFFER)
  C6E9  LOOP UNTIL WHOLE BUFFER IS DONE  >>C6D9

C6EB *********** DETERMINE IF THERE IS MORE TO DO*********************

  C6EB  INCREMENT MAIN BUFFER POINTER
  C6ED  INCREMENT SECTOR NUMBER
  C6F1  IS THERE ANOTHER SECTOR TO LOAD?  (0800)
  C6F6  YES, GO DO IT  >>C6D3
  C6F8  NO, ENTER CODE WE JUST LOADED  >>0801

  C6FB  5 ZERO BYTES AT END OF PAGE
```

ERRATA TO BENEATH APPLE PRODOS (1st Printing, 1984)

You can identify which printing of Beneath Apple ProDOS you have by looking at the space between the title of the book and the author's names on the first page of the book (the title page). If this space is blank, you have the first printing. The second printing has "Second Printing, March 1985" in this space. If you have the second printing, skip to page 120. If you have the first printing, all of the following errata apply.

Page 3-16:

In the first paragraph starting on the page, the sentence should read "The data is dealt with in larger pieces (512 **bytes** vs. 256 **bytes**)...", not **512K** vs. **256K.**

Page 6-63:

The code for "HOW MUCH MEMORY IS IN THIS MACHINE?" is incorrect. Replace it with:

```
        LDA   $BF98       GET MACHID FROM GLOBAL PAGE
        ASL   A           MOVE BITS TO TEST POSITION
        ASL   A
        BPL   SMLMEM      48K
        ASL   A
        BVS   MEM128      128K
        ...               OTHERWISE 64K
```

Page 6-64:

The code for "GIVEN A PAGE NUMBER, SEE IF IT IS FREE" is incorrect. Replace it with:

```
BITMAP  EQU   $BF58        SEE PAGE 8-6
        LDA   #PAGE       GET PAGE NUMBER (MSB OF ADDR)
        JSR   LOCATE      LOCATE ITS BIT IN BITMAP
        AND   BITMAP,Y    IS IT ALLOCATED?
        BNE   INUSE       YES, CAN'T TOUCH IT
        TXA               PUT BIT PATTERN IN ACCUM
        ORA   BITMAP,Y    MARK THIS PAGE AS IN USE
        STA   BITMAP,Y    UPDATE MAP
        ...               WE'VE GOT IT NOW
```

```
LOCATE  PHA                 SAVE PAGE NUMBER
        AND   #Ø7           ISOLATE BIT POSITION
        TAY                 THIS IS INDEX INTO MASK TABLE
        LDX   BITMASK,Y     PUT PROPER BIT PATTERN IN X
        PLA                 RESTORE PAGE NUMBER
        LSR   A             DIVIDE PAGE BY 8
        LSR   A
        LSR   A
        TAY                 Y-REG IS OFFSET INTO BITMAP
        TXA                 PUT BIT PATTERN IN ACCUM
        RTS                 DONE

BITMASK DFB   $8Ø,$4Ø,$2Ø,$1Ø  BIT MASK PATTERNS
        DFB   $Ø8,$Ø4,$Ø2,$Ø1
```

Page 7-9

The code on page 7-9 is incorrect and should be replaced with the following:

```
*       SQUISH OUT DEVICE NUMBER FROM DEVLST
        SKP 1
        LDX   $BF31         GET DEVCNT
DEVLP   LDA   $BF32,X       PICK UP LAST DEVICE NUM
        AND   #$7Ø          ISOLATE SLOT
        CMP   #$3Ø          SLOT = 3?
        BEQ   GOTSLT        YES, CONTINUE
        DEX
        BPL   DEVLP         CONTINUE SEARCH BACKWARDS
        BMI   NORAM         CAN'T FIND IT IN DEVLST
GOTSLT  LDA   $BF32+1,X     GET NEXT NUMBER
        STA   $BF32,X       AND MOVE THEM FORWARD
        INX
        CPX   $BF31         REACHED LAST ENTRY?
        BNE   GOTSLT        NO, LOOP
        DEC   $BF31         REDUCE DEVCNT BY 1
        LDA   #Ø            ZERO LAST ENTRY IN TABLE
        STA   $BF32,X
        CLC
        BCC   OKXIT         BRANCH ALWAYS TAKEN
        SKP   1
OLDVEC  DW    Ø             OLD VECTOR SAVEAREA
```

To reinstall the /RAM driver, execute this subroutine:

```
          SKP   1
*         SEE IF SLOT 3 HAS A DRIVER ALREADY
          SKP   1
HIMEM     EQU   $73         PTR TO BI'S GENERAL PURPOSE BUFFER
          SKP   1
INSTALL   LDX   $BF31       GET DEVCNT
INSLP     LDA   $BF32,X     GET A DEVNUM
          AND   #$70        ISOLATE SLOT
          CMP   #$30        SLOT 3?
          BEQ   INSOUT      YES, SKIP IT
          DEX
          BPL   INSLP       KEEP UP THE SEARCH
          SKP   1
*         RESTORE THE DEVNUM TO THE LST
          SKP   1
          LDX   $BF31       GET DEVCNT AGAIN
          CPX   #$0D        DEVICE TABLE FULL?
          BNE   INSLP2
ERROR     ...               YOUR ERROR ROUTINE

INSLP2    LDA   $BF32-1,X   MOVE ALL ENTRIES DOWN
          STA   $BF32,X     TO MAKE ROOM AT FRONT
          DEX               FOR A NEW ENTRY
          BNE   INSLP2
          LDA   #$B0
          STA   $BF32       SLOT 3, DRIVE 2 AT TOP OF LIST
          INC   $BF31       UPDATE DEVCNT
          SKP   1
```

Page 7-26:

Modifying the ProDOS Disk II Device Driver to allow 320 blocks instead of the normal 280. The fourth command line should read:

```
520D:40
```

Modifying FILER to format 40 tracks instead of 35. The fourth command line should read:

```
4244:40
```

[See Second printing errata for information about versions other than 1.0.1]

Page 8-6:

Under "Device Information", make the following changes:

```
BF10-BF11    DEVADR01    Slot 0 reserved.
...
BF26-BF27    DEVADR32    /RAM device driver address
                         (need extra 64K).
```

Page 8-7:

The wrong bit is indicated as the "expansion bit" in the MACHID byte. The first eight rows of that description should read:

```
00.. 0...  II
01.. 0...  II+
10.. 0...  IIe
11.. 0...  III emulation
00.. 1...  Future expansion
01.. 1...  Future expansion
10.. 1...  IIc
11.. 1...  Future expansion
```

Page B-8:

In the last paragraph, the sentence should read "A second way to use **an interpreted** language..." (not **a compiled** language).

Page D-1:

In the second paragraph, the sentence should read "Versions of the Disk Drive Controller Unit are now **used...**" (not **based**).

Reference Card, Panel 4

Under "SYSTEM GLOBAL PAGE FORMAT", replace the lines beginning BF05 and BF06 with the following two lines:

```
BF06    Jump to Date/Time Address
        (or RTS if no clock)
```

The description of BF10-11 should be changed to:

BF10-11 Slot 0 reserved

The description of BF26-27 should be changed to:

BF26-27 /RAM

Under the "MACHINE IDENTIFICATION BYTE", the second column of numbers should read:

0...
0...
0...
0...
1...
1...
1...
1...

Reference Card, Panel 9

The last entry for "MLI ERROR CODES" should be:

$5A Bad vol. bit map

(not **$58**).

ERRATA TO BENEATH APPLE PRODOS (2nd Printing, 1985)

Page 4-30

The definitions of PARENT POINTER and PARENT ENTRY are incorrect. Replace them with:

$27-$28 PARENT_POINTER: The block number (within the volume directory or a subdirectory) which contains the file entry for this subdirectory.

$29 PARENT_ENTRY: The number of the file entry within the block number pointed to by the PARENT_POINTER. Given that "ENTRIES_PER_BLOCK" is $0D, then the PARENT_ENTRY number ranges from $01 to $0D.

Page 7-26

Expand the 40-track drive patch to show how to patch PRODOS versions 1.0.2 and 1.1.1 as well as 1.0.1.

This patch modifies the Disk II Driver, which is a part of the "PRODOS" file, so that it allows 320 blocks per volume instead of 280 blocks per volume.

```
UNLOCK PRODOS
BLOAD PRODOS,TSYS,A$2000
CALL -151
address*:40
3D0G
BSAVE PRODOS,TSYS,A$2000
LOCK PRODOS
```

*"address" varies with the version of ProDOS, as follows:

ProDOS Version	address
1.0.1	520D
1.0.2	52CD
1.1.1	56E3

The following patch modifies the program FILER to format 40 tracks instead of 35. After this modification is made, only 40-track drives may be formatted with FILER.

```
UNLOCK FILER
BLOAD FILER,TSYS,A$2000
CALL -151
addr**:40
79F4:28
3D0G
BSAVE FILER,TSYS,A$2000
LOCK FILER
```

**"addr" depends on the release date of FILER. Here are the values of "addr" for two different release dates:

Release date	addr
1 JAN 84	4244
18 JUN 84	426A

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